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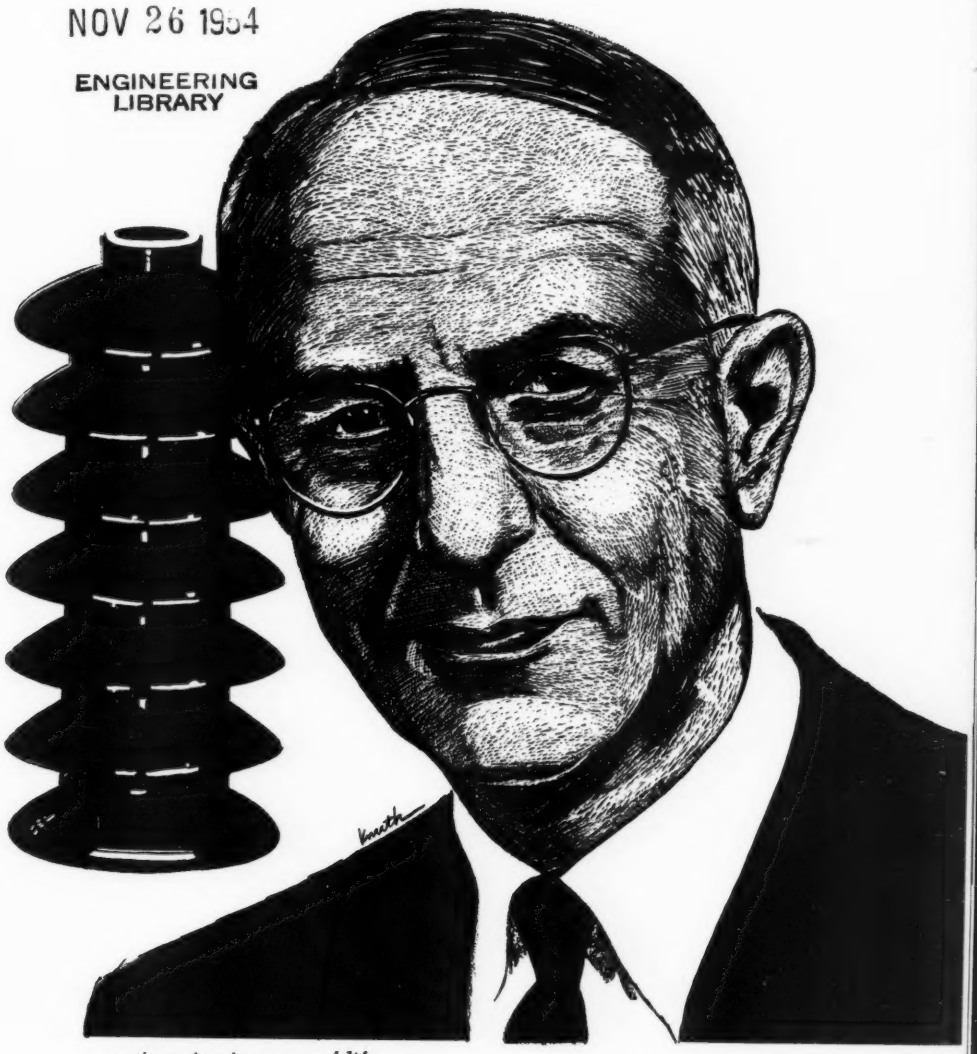

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JAMES HAROLD FOOTE has been closely associated with design and engineering of electrical utilities for over forty years. The history of utility operations during that period has been almost a continuous series of crises, ranging from Government legislation and control to the depression years,

—Continued on page 10

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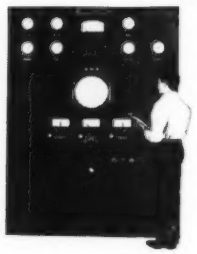

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VOLUME 4

NUMBER 5

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consulting engineer

NOVEMBER 1954

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READERS' COMMENT

Way Up Yonder . . .

Sir:

Our organization is involved in a study of the economic development of the northwest section of North America. We are concentrating particularly on the area comprised of British Columbia and the Panhandle of Alaska.

To assist us in our work we are anxious to accumulate a substantial literature file of pertinent magazine and newspaper articles. Would it be possible to learn from you of any feature articles which have appeared in your publication in the last 3 to 5 years? In addition, if tear sheets are available on these articles we would be deeply grateful to receive duplicate copies of them.

H. Jacobson
Singmaster & Breyer, Inc.

• SEE PAGE 32 OF THIS ISSUE.

Commended Once

Sir:

Allow me to commend you on the last several issues of the CONSULTING ENGINEER. The articles are most interesting and timely.

If available, would like to secure tear sheets of the article "Air Conditioning for Indoor Swimming Pools" by Mr. Eugene B. White.

T. C. Brown, P. E.
Raleigh, North Carolina

Commended Twice

Sir:

It has been interesting to watch the growth and progress of your magazine — CONSULTING ENGINEER — since the first issue appeared several years ago. You are to be commended for your astute selection of technical and professional articles. I have found many of them very interesting and illuminating and I notice that members of our staff at F. H. McGraw & Company pass the magazine back and forth and often make notes from various stories. Also, your editorials and personality stories seem to be well selected and very well done.

You deserve congratulations for the fine editorial job you have done and the service rendered to the engineering field — keep up the good work!

Clifford S. Strike, President
F. H. McGraw & Company, Inc.

Commended Once Again

Sir:

I want to thank you for including our firm on your mailing list. I have read every issue since, I believe, the first.

Your publication is interesting and helpful and improves with each issue. Keep up the good work.

Gilbert I. Ross
Ross & Company
Engineers and Consultants

A.A.E. Agrees

Sir:

We compliment you on an excellent publication with good, meaty, down-to-earth articles, which cannot help but be of considerable interest as well as help to the members of the engineering profession.

Your editorial "Scraps and Shavings" read just like A.A.E. material, as you are expressing some of the identical things that this Association has preached, advocated and worked for ever since its inception in 1915. Perhaps we were a little too advanced in our thinking; nevertheless, every word you say in your editorial and everything we have preached on this subject is the gospel truth.

You have a very interesting article about one of our valued members in this particular number — Mr. Michael Baker, Jr. — that we would like very much to reproduce in our own publication, *Professional Engineer*, provided we have your permission to do so. Naturally we would give your magazine full credit, at the same time calling our members' attention to your excel-

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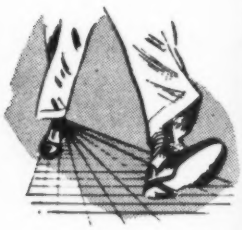

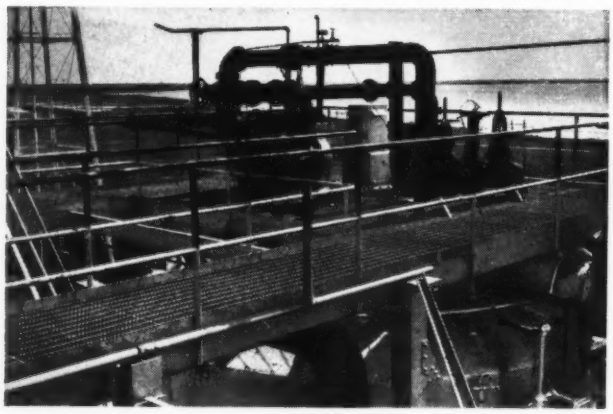

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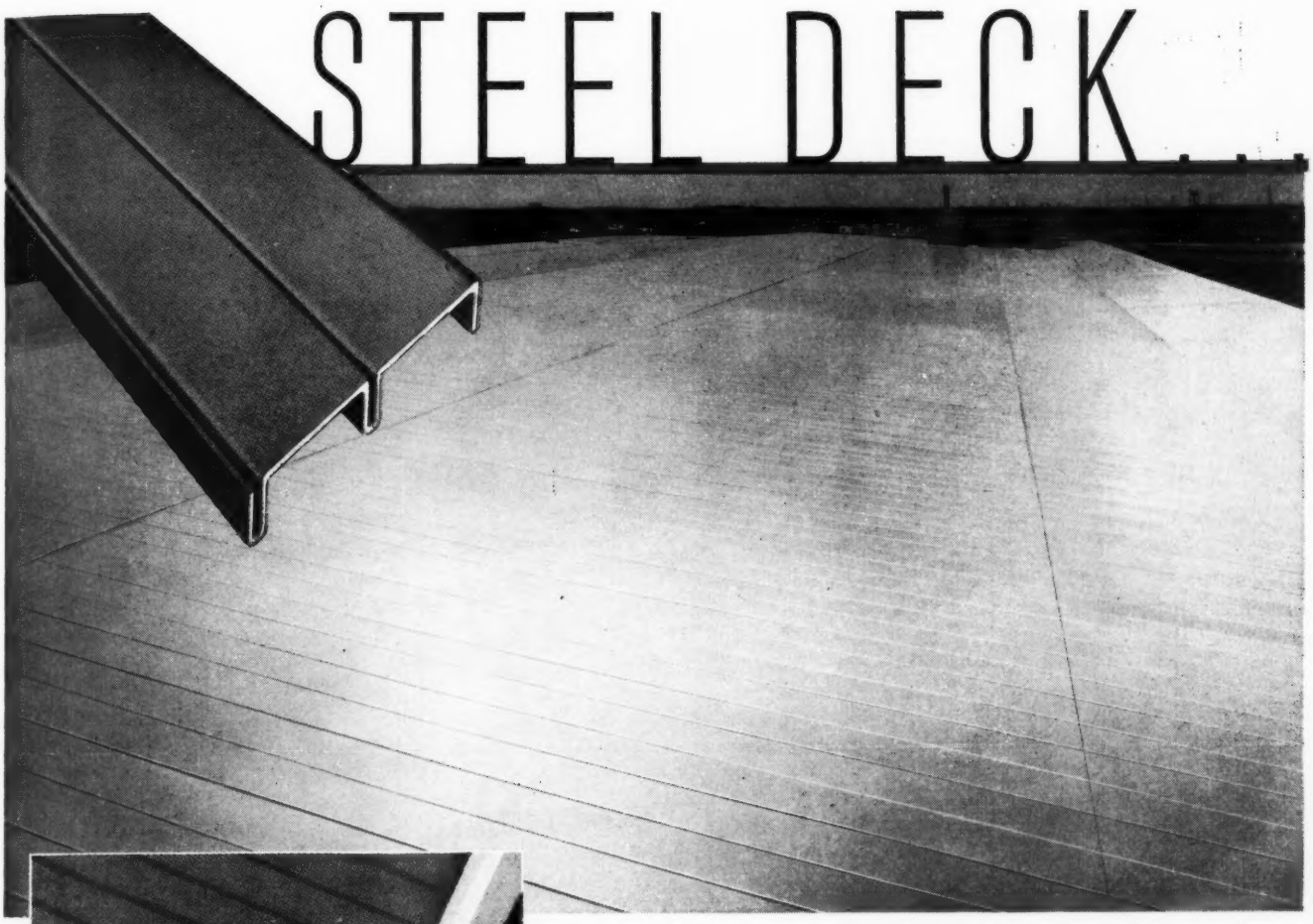

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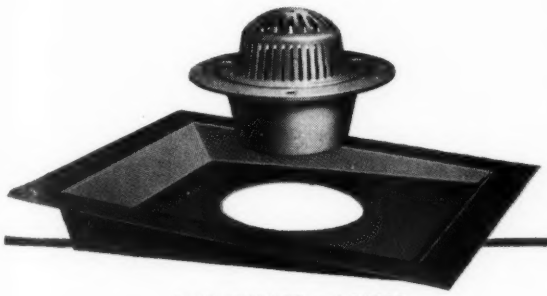

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lent publication because we have many consultants in our membership, of course.

Some time back you had a most interesting article on Ethics, to which we made mention in an article I prepared for the Annals of the American Academy of Political Science. This is a subject in which the American Association of Engineers has done considerable research and study over the past thirty-five years, and as you perhaps well know is not only a most controversial subject, but one that is of interest to consultants.

More power to you!

H. A. Wagner, Past President
American Association of Engineers

Inartistic Name

Sir:

I think you are doing all right.

The weakest aspect of the magazine is I think its art. If there is one place where the best art should be applied it is the name of the magazine. And how inartistically that is done!

Aram Boyajian
Consulting Engineer

For The Record

Sir:

We are finally getting around to reading the September issue of CONSULTING ENGINEER and want to call your attention to an item on page 88 regarding tunnel records.

. . . there is a company claiming 111 feet in 24 hours. The Bureau of Reclamation is squabbling over this figure with the contractor and may or may not allow the full footage, however regardless of the outcome it will be — in all probability — in excess of the 104 feet set at Owens Gorge.

Since this has never, as far as we know, been placed in the record, your reporting is accurate. For the sake of the close knit fraternity of those who follow the tunnel driving trade we suggest that any further mention of this acknowledge the fact that a contested footage was set on North Poudre tunnel as a most recent mark.

Certainly, Welsh Construction Company or any other contractor who is setting out to break a record would wish to shoot higher than even a questionable claim to be sure of an undisputed record. We believe the contractor on North Poudre tunnel in Colorado has some good basis of claim to that record — he's an outstanding man, had an outstanding crew, and the best equipment money could buy.

D. W. Saunders
Matsie Company

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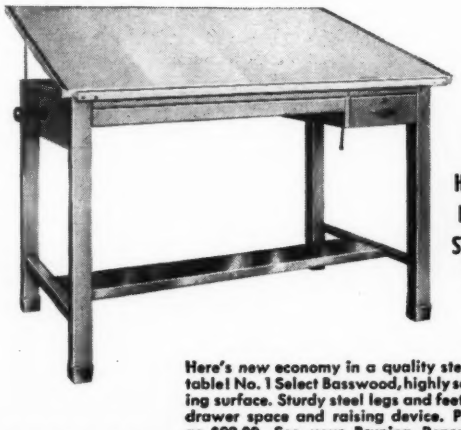

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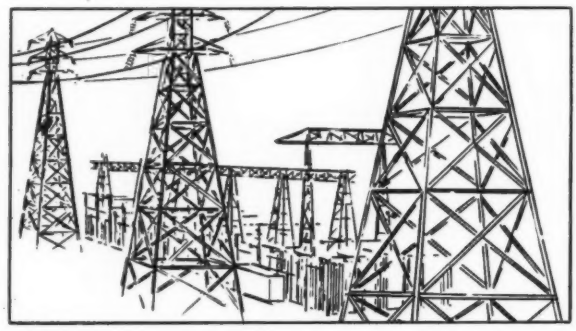
Serving the Giants

—Starts on Front Cover

and including such episodes as the rise and fall of the Insull Empire, the era of the New Deal, and two World Wars. Against that checkerboard background, Foote's professional career appears a simple narration of a single-minded interest and devotion to his engineering work and to the problems of his profession. Today, he is President of his organization, Commonwealth Associates, Inc. of Jackson, Michigan, and he bears few of the scars from political, economic, and social battles of his times.

Now, more than ever, the utility business is a public trust under the close scrutiny of public officials. Because of its enormous responsibilities as a basic industry in the American economy, it is faced with the dual pressures of having to be conservative in its operations, yet always searching for still better and more efficient ways to generate and distribute power. Harold Foote and Commonwealth fit into this pattern.



Foote has actively worked for the goal of engineering registration for many years through the various Michigan engineering societies and on the national level. (He served seven years on the Michigan Board of Registration.) On this issue his viewpoint is as dogmatic as it is conservative.

"Every man who assumes responsibility for the design or engineering of a machine or member that will directly or indirectly affect the public safety should be registered." Furthermore, says Foote, "the registration laws should require a high degree of professional competence as proven by educational background, responsible experience, and written examination criteria; and these requirements, to be effective, must be honestly and rigidly administered and enforced."

Incentive

On the other hand, if a man is going to do his best work, he has to have a real incentive. "We think that at Commonwealth we have one of the best incentives possible since every member of our group is interested in the success of our business. It is solely owned by the employees and our jobs, salaries, profits are everyone's concern. Therefore, it is to the direct benefit of our engineers to please our customers, to help us produce efficient designs, and to keep costs down. I believe an incentive makes for a strong team spirit, attracts and holds a high calibre engineer, and rewards him fairly for his initiative and enterprise." Mr. Foote feels that this method successfully resolves the problem of getting the best out of his engineers while in no way impairing the quality of their work. It is a unique solution among consulting firms.

The question involving the ethics of bidding has made its round at Commonwealth, too. "Frankly, we've experimented with lump sum bidding and we've been burned. In any job, there are the inevitable misunderstandings or misinterpretations of what the client actually wants and what the consultant thinks he wants. A lump sum bid leaves no room or flexibility for these necessary modifications or changes. The customer wants to hold you to the terms as he sees them and the engineer is either forced to comply, possibly by cutting corners in the engineering, or he has the alternative of disputing the point—a sure way to create ill-will. Either way the consultant stands to lose.

"While it's true that we do probably lose some jobs because we refuse to bid, I maintain that in the long-run we are better off. Our business, like that of most other consultants, is built on customer good-will, service, and repeat jobs over a long period of years. And since bidding does not help that relationship, but instead proves to be an obstacle, it has no place in the consulting profession."

Commonwealth has acted as a consultant on many jobs, from planning power systems to designing generating plants. It lists among its customers, Central Illinois Light, Columbus and Southern Ohio Electric, Detroit Edison, Dow Chemical, Ohio Edison, Consumers Power, and other utility and industrial companies. "We work hand in hand with the client. We follow his ideas and suggestions, provided they are sound engineering-wise, since he is the one who will have to operate his plant and equipment.

"When it comes to equipment selection, we call in the appropriate manufacturers of the particular items and ask them to submit bids. These bids are completely evaluated, not only from the standpoint of costs, but from serviceability, maintenance, reliability of operation, and all other pertinent factors. These factors are weighted and presented to the client for his final selection without prejudice or recommendation on our part other than to show him exactly what he is getting for his money."

In his quiet manner, this is how Harold Foote seeks to further his profession. ▲▲

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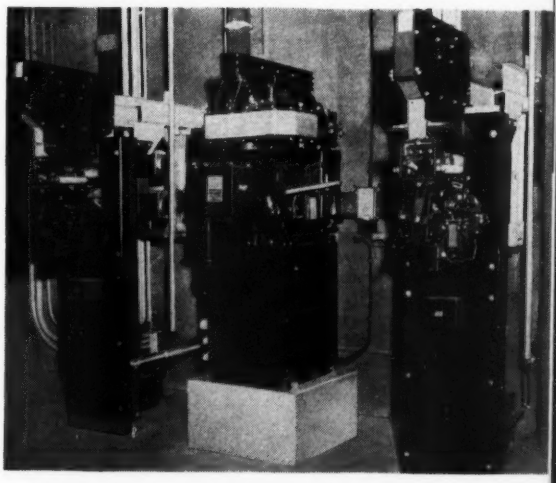

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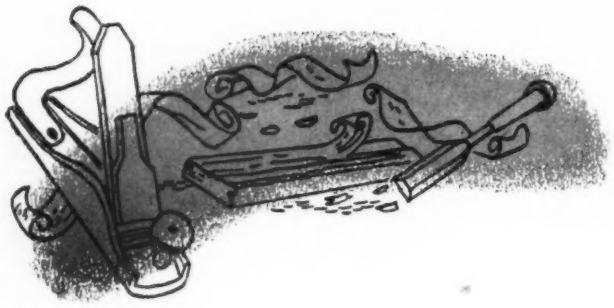


SCRAPS & SHAVINGS

PRACTICING PROFESSIONAL ETHICS means more than just being a good boy. It is time that engineers understood the difference between pure ethics and professional ethics. Pure ethics is the science of moral duty. At this particular point we are not interested in the pure ethical standards of engineers. They can be egoistic, hedonistic, eudaemonistic, or they can be unkind to their mothers. This is none of our business. Engineers, as other men, should have learned their pure ethics at home, at school, or at church.

It is professional ethics in which we are interested. Very good men can be wanton wreckers of professional ethics merely because they do not know the rules. And so few engineers, even consulting engineers, do know the rules.

To be professionally ethical, you first should get hold of a code of ethics; second, you should read it until you understand it and think you can apply it to any situation that might arise; and third, when the situation does arise, you should act within the intent of the code.

It sounds simple. Actually, it is very complicated. Even the first step is more difficult than it would appear. There are a couple of dozen good codes around, so the question is, which code should you use. The most generally accepted code is the one prepared by the Engineers Council for Professional Development, called "Canons of Ethics for Engineers." But suppose that you are a member of the American Society of Civil Engineers; that august organization also has its own "Code of Ethics." If these two codes merely elaborated on each other, it would not be a matter of much importance — but that is far from true. There is an item in the ASCE code that says it is wrong "To participate in competitive bidding on a price basis to secure a professional engagement." The "Canons of Ethics" says nothing about competitive bidding.

So let's say that you decided that you wanted to bid on the bridge job in South Carolina that was advertised as accepting sealed bids on the engineering work. You want to be professionally ethical, so you run down all the items in the "Canons of Ethics," and so far as you can see, competitive bidding is perfectly ethical. So you bid.

Next thing you know, you are called before a special committee of ASCE, and they decide that you were not only unethical, but they end up by either expelling you from the Society or suspending you for one to five years. On August 20, the Board of Direction of ASCE, acting on this South Carolina case, expelled one member, suspended one member for five years, and suspended other members involved for one year each.

We do not question the wisdom of the Society in these decisions. Their members should have known the ASCE Code, and if they wanted to remain in the Society, they should have abided by the Code.

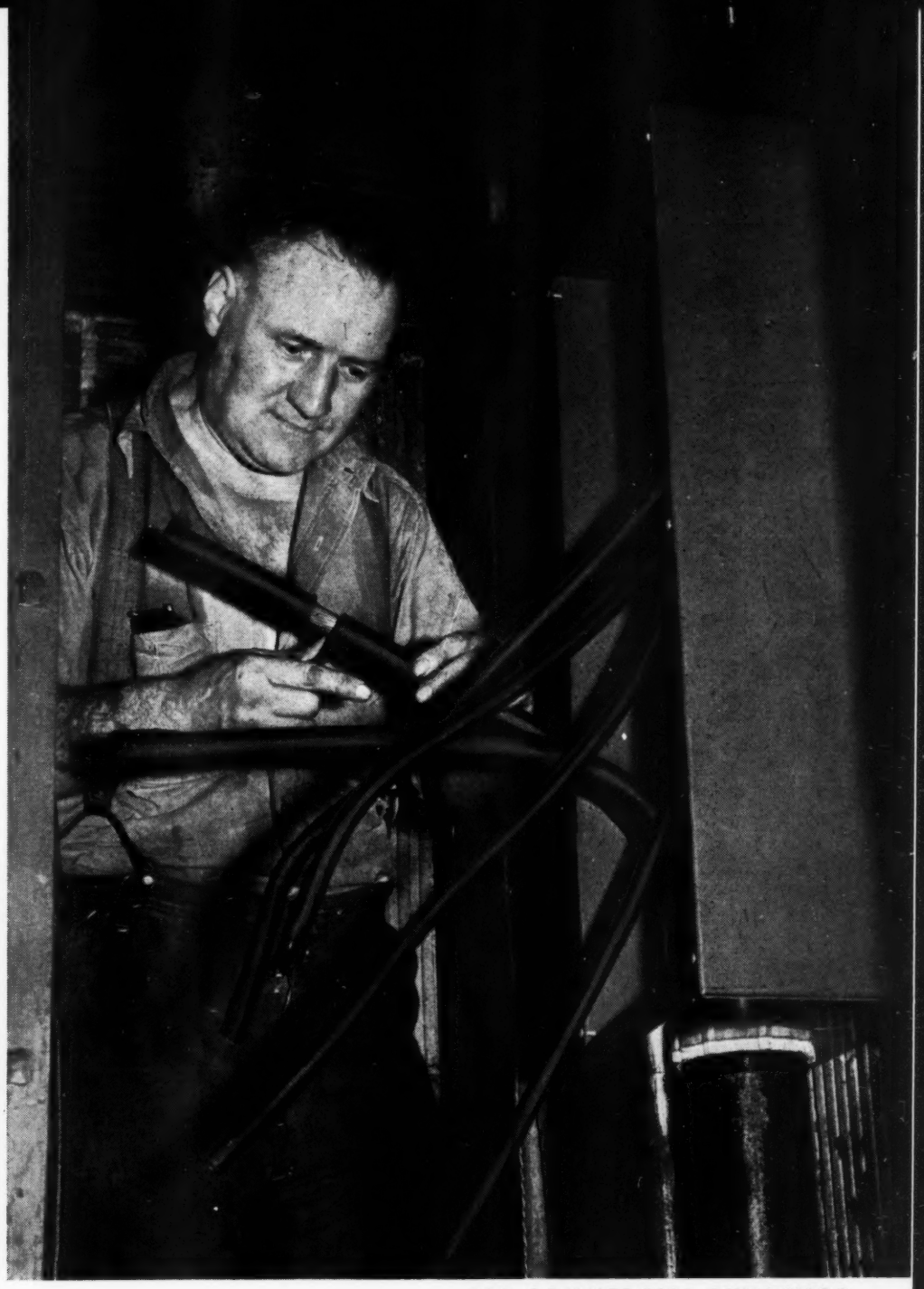
We do question the wisdom of having a couple of dozen codes of ethics. It is difficult enough for the engineer to abide by one.

Even if there were but one accepted code, there would remain the second problem, that of interpretation. The codes, themselves, can be compared to statutory law. They are clearly stated, but they must be applied and interpreted for every borderline case. It is on precedents set by prior court interpretations that the attorney must base his plea for the case at hand. In the field of professional ethics, ws have not built any record of interpretation. At a meeting of Engineers Council for Professional Development, in Cincinnati, just a few days ago, Dean Freund, of the University of Detroit, brought out this need for publication of cases in professional ethics. He suggested that the records of engineering ethics should be studied and that a collection of case histories should be prepared that would illustrate ethics in action — the problem involved, and the action taken, if any.

CONSULTING ENGINEER offered its help. This month, on page 68, under the heading, "A Matter of Ethics," we have presented a case. It is a simple one, involving more the will to do the ethical thing rather than the knowledge of what is ethical. Other examples printed in later issues may be more difficult.

We invite you to send us case histories in professional ethics that have come to your attention. We will publish one or more of these case histories each month. When a sufficient number have been published to warrant their collection into a booklet, they will be reprinted and offered to ECPD for distribution in any manner they feel would be most helpful to the whole profession.

. . . FOR UTILITIES



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ECONOMIC NEWS NOTES

E. F. Mac Donald
INDUSTRIAL ECONOMIST

RESEARCH FOR RENT — Battelle Institute plans a $1.5 million expansion of its nuclear energy research facilities. These will be available to private companies that want to engage in nuclear research without costly investment in staff, plant, and equipment.

QUALITY CONTROL — For less than $5,000 a quality control and research laboratory can be set up by the small processor and manufacturer. The Scientific Apparatus Makers Assoc. bases this figure on the establishment of a pilot lab and on its work with the National Confectioners' Assoc., co-sponsor of the pilot lab operation. Market investigation by SAMA uncovered a definite trend among smaller manufacturing concerns to use scientific methods to improve quality and to make use of newer and more economical products. The new Internal Revenue Code aids this trend, since it permits a company to either charge off in one year an investment in a research lab or to amortize it over five or more years.

HERE'S HOPING — One of the goals of the Administration is to "get the economy going up at a rate of 3 percent a year" and to reduce Federal government spending so that corporate and personal income tax rates can be lowered. Under-Secretary of the Treasury Folsom pointed out in a recent address that the increase in business stimulated by tax reduction would offset the reduction in government spending.

TAX AID — The Office of Defense Mobilization has announced that companies with defense contracts that locate plants in any area classified by the Department of Labor as having a substantial labor surplus (Group IV) will be allowed rapid amortization for tax purposes. The portion of the total capital investment certified as related to defense production can be written off in as short a period as five years.

SUPERSUBURBS — One of the best examples (and causes) of the current boom in construction of commercial facilities is the record level construction of suburban shopping centers. In a recent issue, ***Chain Store Age*** reported over 500 shopping centers in the blueprint or early construction stages.

SOLAR ENERGY — Household appliances and scores of other products powered by solar energy are likely to be in fairly common use within the next five years, according to Dr. Maria Telkes, of N.Y. University's College of Engineering. Appearing on the same program of a National Industrial Conference Board meeting, Mr. C. G. Abbott, of the Smithsonian Institute, stated that the scientific know-how has already been worked out for making small solar-power machines, up to 5 hp, for irrigation, heating and cooling homes, charging batteries, and for similar uses.

PIEDMONT POWER — The largest steam generating plant in the Southeast will be built by the Duke Power Co. near Belmont, N.C. Costing over $24 million, the plant will have a continuous capability of 1,000,000 kw. Condensing water for the generating unit will be drawn from the Catawba River and discharged through a mile-long tunnel into the South Fork River.

DEFENSE STOCKPILING —The stockpile of strategic and critical materials is now valued at $4.5 billion and will be increased by $2.5 billion in order to reach the minimum objective, Defense Mobilizer Flemming announced. Continued stockpiling will proceed "just as rapidly as supplies become available and without creating undue hardship for the civilian economy." He added that the Defense Department plans to award $100 million of contracts for deferred delivery of tools essential for defense but not used in ordinary manufacturing. A $40 million program will be initiated also for making "elephant" tools — the ponderous-size tools needed for production of giant military items.

GROWTH INDUSTRY — Concurring in estimates of a 400 percent growth in chemical production by 1975, Mr. H. S. Ferguson, vice president of Allied Chemical & Dye, states that future growth will be based on increasing research activity. He points out that research amounting to $300 million annually results in the marketing of one new product a day. All of which indicates that the current slowness in construction of chemical facilities is not likely to be protracted.

THROUGH THE TRANSIT — The Scandinavian Airlines begins flights this month between Copenhagen and Los Angeles—via the North Pole. . . Assuring continued high levels of new construction by states and municipalities is the record volume of borrowing by these governments this year, much of which has not yet been committed. . . . A 7¼ mile-long conveyor belt, the longest in the country, has been put into operation by the Potash Co. of America. It was installed by Hewitt-Robins, Inc. . . . Distillation of sea water for industrial uses will be a pioneer operation at the new power plant being constructed by Pacific Gas & Elec. at Morro Bay, Calif. . . . The recently opened Johns-Manville plant at Asbestos, Quebec, is the nearest thing yet to the "push-button" factory. . . . Mr. Rosano of American Cyanamid says that one dollar invested in industrial research should result in five sales dollars. He adds that a research expense dollar generally will require five capital dollars some six years later. . . . Inept management is worse than lack of adequate working capital, according to a new booklet of the Small Business Administration, "Handbook of Small Business Finance." Dun & Bradstreet has been pointing that out for years. ▲▲

ATOMS IN ACTION

HOPES ARE NOT EQUAL to facts in nuclear power. It is being pointed out that present calculations establishing the economic feasibility of atomic power have not taken into account the fact that conventional power will undoubtedly cost less in the future (though today's prices are used in most feasibility studies) because of present development programs. It is also being pointed out that current feasibility studies do not recognize that the return on risk capital for nuclear stations will have to be somewhat greater than for conventional stations because the risks cannot be proved to be the same as for conventional plants. Feasibility studies, too, have not considered that the load factor for conventional plants can be better than 95 percent whereas the nuclear plants most nearly ready for power production have but 85 percent load factor.

BY 1964, it is expected that 2 million kw of nuclear power will be installed, but this is only 1.2 percent of the nation's expected total capacity. By the year 2000, 50 percent of the utilities' capacity will be nuclear powered. But even then, there will be two or three times as much capacity in coal, oil, and gas as there is today. Present equipment will not be obsolete until worn out.

ANOTHER PROFESSIONAL society has joined the ranks of the many. The American Nuclear Society (originally called the Society of Nuclear Scientists and Engineers) was formed in Washington a few weeks ago . . . Ebasco and Fluor have joined the 16th nuclear power study group authorized under the AEC's Industrial Participation Program; they affiliated with 7 other firms to form the Rocky Mountain group, studying the feasibility of a power reactor for the Western States . . . A new atomic battery has been developed using the heat from radioactivity in polonium to produce electricity . . . The ASME has set up a Nuclear Engineering Committee to coordinate the society's activities "in those areas of mechanical engineering in which a knowledge of nuclear physics is essential."

ENVIRONMENTAL PROBLEMS are expected to be of more "than average depth" in atomic energy industries. The cost of disposal of wastes from atomic energy industry are much higher than ordinarily suspected. Fears exist that these high disposal costs will lead to cutting of corners — a very dangerous thing, especially for an infant industry that can afford no breaches of public confidence. The whole problem of integrating atomic industry into the national industrial community is seen as a matter of learning how to live with radiation without damage to life and property.

ENGINEERING SERVICES are being sought for the design of facilities for feed materials production; the sites listed by the AEC are St. Louis, Mo., Fernald, Ohio, and Paducah, Ky. The three-year program is expected to cost $73.4 million.

NEW GADGETS are still coming out for those with a nuclear bent. For geophysical prospecting from low-flying planes, from a moving land vehicle, or on foot there is now a "Nucliometer." It is made up of 24 Gieger tubes and is recommended where great sensitivity is needed. The same firm puts

ATOMS IN ACTION — Starts on page 21

out a "Scintillometer." The device is said to be 100 times more sensitive to gamma radiation than standard Geiger counters. Aerial radioactivity surveys using the device are the latest thing in diamond exploration.

WITHIN THE NEXT two years, Great Britain will add 100,000 kw capacity in nuclear-generated electricity to the regular power grid of the British Electric Authority, the nationalized utility supplying the vast majority of England's power needs. This will be the electric power equivalent of 20 million tons of coal per year. Experts say that it is not a matter of whether it can or cannot be done. They say it must be done.

COLD-TURKEY TALK was dished out to American industry by Lawrence Hafstad, director of the AEC's Reactor Development Division. He feels that the time is past when we can get along with paper studies and economic analysis; we should be building atomic power plants now. The present slow pace will put us far behind other countries if industry does not become more aggressive in taking over the reins from government. He said the AEC is happy with the new Atomic Energy Law, but that business can no longer expect to learn the atomic energy business by spending government contract funds. Anything over and above the AEC's current five-year reactor development program will be the responsibility of industry. Hafstad is also concerned because information being declassified is not being used by American firms to any appreciable extent. He cautioned that American firms may not be giving proper respect to the problems of radiation hazards. Hafstad wound up by pointing out that if industry continues, by default, to let government plow money into the atomic energy power program, future cries of "giveaway" will have great validity; the longer the government carries the ball, the harder will be an equitable shift to industry initiative. He offers some positive suggestions: industry could develop a patented fuel element for mass production (a really good, economical, element does not yet exist), it could sell reactors, and it could assign the high-salaried brains of industry vice presidents to take over from the $10,000 civil-service government noggins.

RECENT STATISTICS show that nearly 18,000 prime contracts and purchase orders were issued last year by the AEC. More than 5000 firms held prime contracts; 375,000 subcontracts and purchase orders were issued by them. Around 60 firms have been organized into 17 groups for research studies, at their own expense, as of this Fall. Since 1951, private contractors have spent some $3 million surveying reactor technology, and the AEC expects this to go to $8 million by the end of this year. (The government has shelled out $300 million for research so far.)

UNDER WAY is still another independent study of the development of industrial nuclear power and its by-products — the 17th in the AEC's Industrial Participation Program. Bethlehem Steel's Shipbuilding Division will undertake a one-year investigation into the application of nuclear power to commercial ship drives. This is the second survey aimed at marine propulsion. Bethlehem will look into reactor types, steam cycles, control methods, machinery arrangements, and weight. This will be followed by detailed design of reactors and propulsion equipment. They also will look into packaged reactor plants for land-based electric stations and for sea-water distillation.

AGRICULTURE is a beneficiary of the atomic energy program, though it is not always appreciated that this is so. Through the use of isotopes, better understandings of fundamental biological processes have developed. Such understandings imply potential effects of great magnitude. Four classes of processes have come under scrutiny: photosynthesis (the process by which green plants convert the sun's radiant energy into chemical energy), plant nutrition and physiology, animal nutrition and physiology, and genetics, including applications to plant and animal improvement. For example, plant diseases cost agriculture $3 billion annually. Irradiating seed promises to induce disease immunity; so far, results with corn and oats are very encouraging. ▲▲

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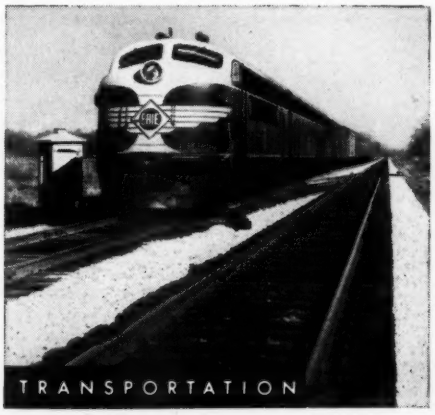

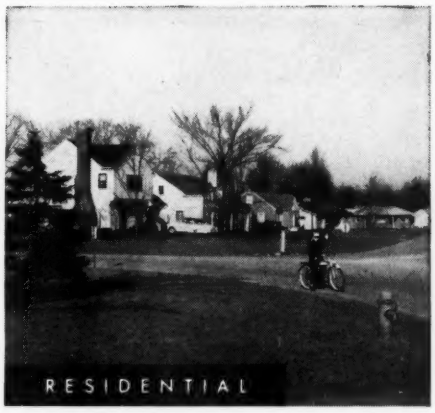

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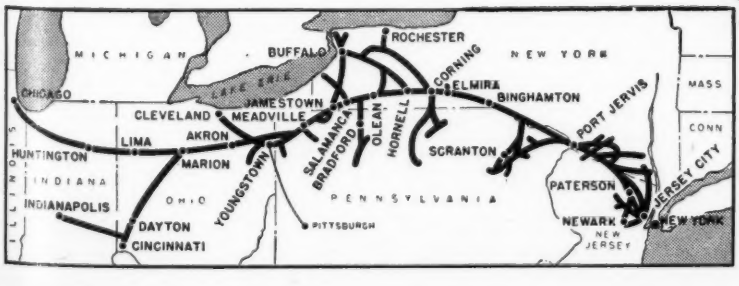

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WHEN IS AN INVENTION not an invention? According to patent law, it is not an invention when it is not "inventive"—that is to say, when the result achieved is "obvious." The mere fact that no such invention had ever been produced before is not proof that the device or process was not obvious. Probably, no one bothered to produce the invention before because there was no significant need for it.

Thus, according to American patent law, the inventor has two principal hurdles to leap. He must not only show that his invention is new, but also that it is "inventive." This is different from the requirements of most nations' patent laws, which only require that the device or process be "new" in order to be patentable.

What is "obvious" is anything but obvious. It is the greatest unsolved problem in patent law. No one has yet figured out an objective test of inventiveness. At one time, a court came up with the proposition that nothing was inventive unless it came as a "flash of genius." Unfortunately, we know even less about genius than we do about obviousness, and this test proved to be only a "flash in the pan." At present, the only criterion of whether or not an invention is inventive is this: it is inventive if the court says it is, and it isn't if the court says it isn't. Most often, the court says it isn't.

Glass Case

An interesting case in determining whether an invention is "new" or "inventive" is *In re Roger Emile Lambert and Pierre Arbeit,* 212 Fed. (2d) 594; 101 U.S.P.Q. 393, decided March 23, 1954. The inventors had evolved an improved process and apparatus for the continuous production of glass. Their patent application contained 34 claims. All but one were rejected for lack of novelty or of inventiveness.

The improvement is embodied in a three-compartment tank furnace. The solid glass-making materials are introduced into the first compartment, where they are heated to melting. The molten glass flows continuously into the adjoining refining compartment. Here impurities and bubbles are removed by increasing the fluidity through the application of further heat. The refined glass next flows into the "working" compartment for thorough cooling prior to actual use.

The principal objective of the invention was to produce a more uniform product at less cost. The method involved flowing the molten glass in a shallow stream from the surface of the melting compartment to the top of the refining compartment. In the refining compartment, the upper portion of the glass was rapidly heated by an electric current that flowed from electrodes through the upper layer of glass, thereby releasing the bubbles from the thin upper layer of the glass. The refined glass then became heavier as the bubbles were removed; therefore, it sank to the bottom of the refining compartment. It was then withdrawn as an underflow from the refining compartment and fed to the working compartment.

For purposes of fuel economy, the temperature in the melting compartment was lower than that in the refining compartment—the heat in the melting compartment being provided by combustion of a fuel. In order to make sure that no glass would short-circuit the refining compartment by sinking immediately to the bottom, the glass was given a head start toward attaining the refining temperature by electrically heating the shallow stream of molten glass passing from the melting compartment to the refining compartment.

New, But Not Inventive

It is admitted that there never was such a method or such apparatus before, and that the "invention" accomplishes a useful and worthwhile purpose. However, this method and apparatus were held not to be "inventive" despite the fact that they were new. The Patent Office rejected the 34 claims on the

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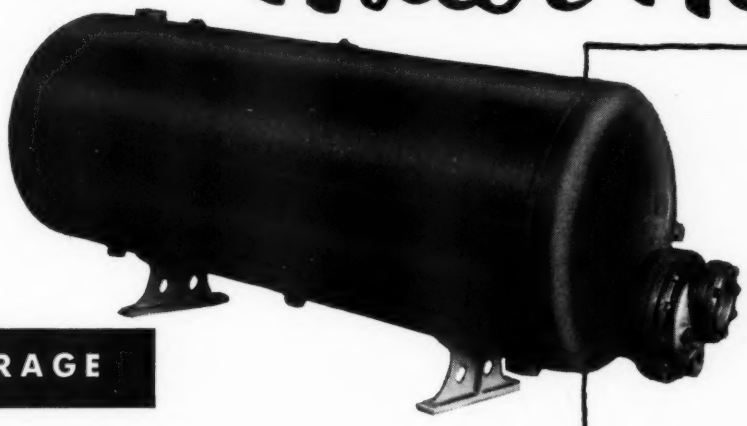

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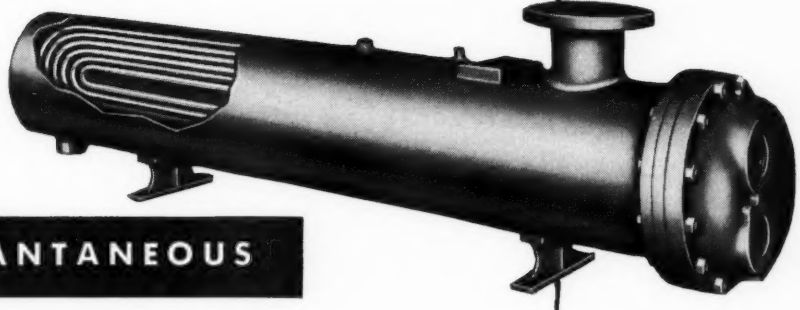

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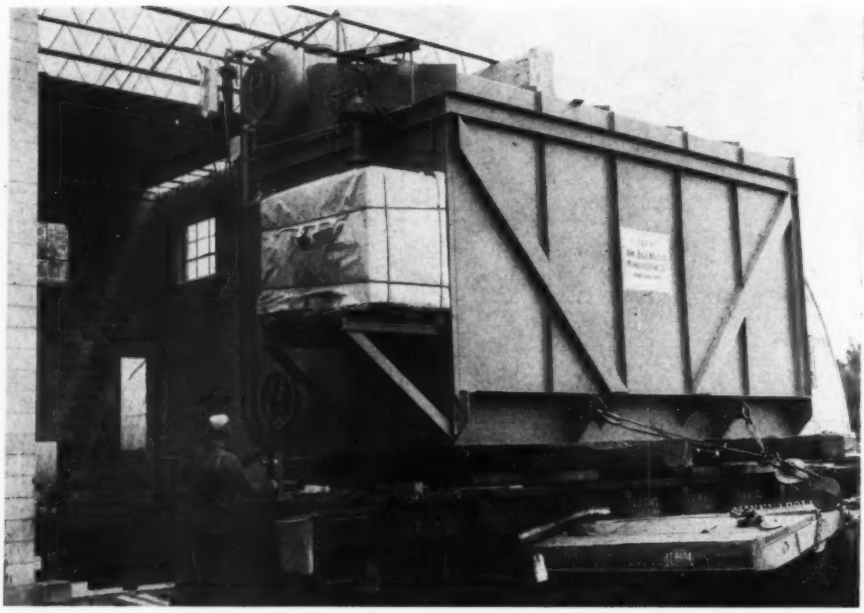

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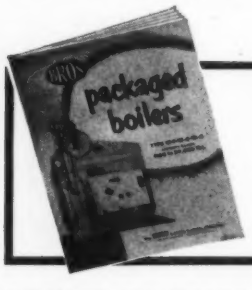

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ground that they encompassed a "mere aggregation" of ideas already covered in two separate patents. Neither prior patent alone anticipated the invention, but it was said that both together did. (The two patents were Wadman 1,880,541 and 1,944,855.)

Refining a Point

The latter of these two patents described a two-compartment furnace; one was a melting compartment and the other was a working compartment. The melting compartment was heated by combustion. The molten glass overflowed from it, went through an electrically heated space, and entered the bottom of the working compartment. This Wadman patent had been interpreted in a previous case and the court had held that "refining" of the glass was completed before arrival of the glass in the working chamber. But in the present case, the same court held that the working chamber could be "considered a refining chamber although clearly that is not its basic purpose."

According to the court, the question wasn't whether Wadman performed all of the refining in the working chamber, but whether he performed—or could perform—*any* refining in it. The court said there was nothing to preclude this, so it must be regarded *this time* as a refining chamber even though it was regarded as *not* being a refining chamber in the other case!

Bubbles

This means that Wadman added electrical heat to the glass flowing from the melting chamber to the refining chamber. But, as the court pointed out, that is, "precisely the operation claimed by the present inventors (Lambert and Arbeit)." Although in the present invention, the glass enters the refining chamber still full of bubbles (and in Wadman's patent it enters virtually free of bubbles), the court said that in the present invention "substan-

tial refining may occur in the shallow channel prior to delivery of the glass to the refining compartment." As the court said, there was nothing in the rejected claims that would "preclude the fact that substantial refining may occur in the channel" of the present invention. That being the case, the present invention was no different from Wadman's patent 1,944,855—so far.

The final step in the present invention was electric heating of the upper part of the refining compartment, following the heating of the stream flowing from the melting chamber to the refining chamber. While Wadman did not do that in the aforementioned patent, he mentioned that "the glass in working chamber may be further refined in any suitable or desired manner." Taking this statement together with the other Wadman patent, 1,880,541, the court held that the present inventors had merely made an obvious "aggregation of the ideas disclosed in the two Wadman patents taken together."

Precaution Not Inventive

The fact that in the invention of Lambert and Arbeit special precautions were taken to feed a shallow stream of glass to the *top* of the refining chamber, while in Wadman's patents no such precaution was taken, was discounted as not inventive. Actually, that is really the crux of the invention, since that is what makes the refining work so well. Wadman's refining method is much cruder.

One finds it hard to agree with the court and with the Patent Office on this decision. It is tenuous reasoning, which seems to go far out of its way to prove that something was obvious all along. But it is pretty doubtful whether anything can be obvious which takes such a long, complicated series of weak arguments to prove. The attitude of the court is reminiscent of a famous U.S. Supreme Court case that, in 18

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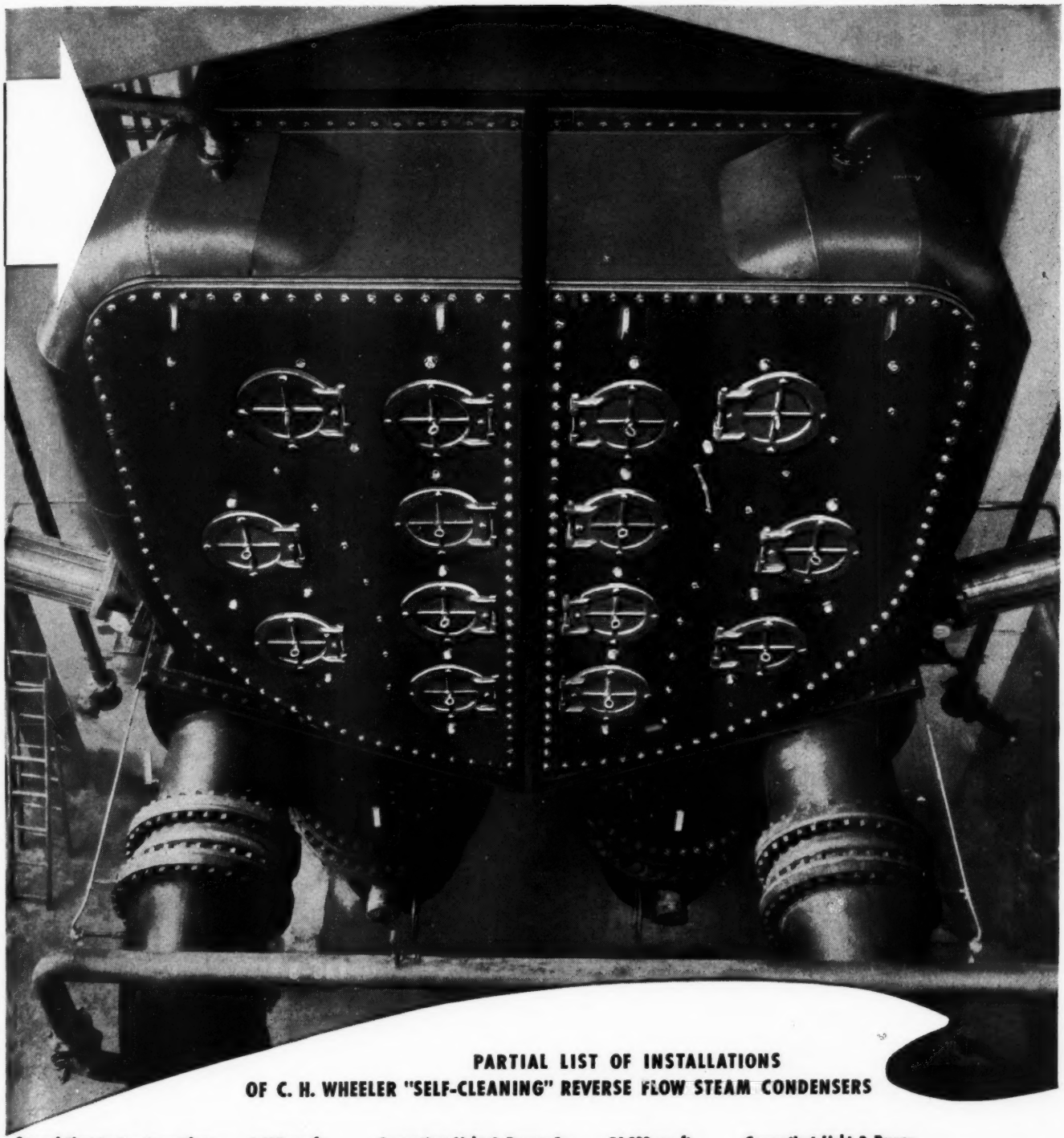
pages of closely knit legal reasoning, proved that the word "necessary" in the Constitution does not really mean "necessary" because it doesn't say *positively* necessary! (*McCulloch v. Maryland*, 4 L. ed. 579).

At any rate, this case illustrates the extreme difficulty of knowing in advance whether or not an invention is inventive enough to be patentable. The odds of getting a court to grant a patent (or claims) that the Patent Office has rejected are about 6:1 against you. And the odds of getting a court to uphold a patent that has been granted by the Patent Office in a suit against an infringer, (for example,) are almost as bad. In other words, it's not so much that the court agrees with the Patent Office as it is that the court finds it difficult to believe that there is really "anything new under the sun." ▲▲

cp quotes --

Engineering is considered a profession similar to medicine, dentistry, public accounting and several other professions which are recognized by law . . . Engineering differs from other professions in that while engineering itself is an individual matter as is the practice of other professions, corporations have a large part in the engineering profession but not in the others. It is estimated that 90 percent of practicing engineers are employed by corporations and corporate activity in the engineering field has been built up by reputable concerns during the past 50 years due to the demands from industry . . . In the future, it is possible that some standard code of ethics may be established which would strengthen the position of individual engineers, corporations and partnerships . . . This is a major and important effort and calls on the best thinking of all classes of engineers. . . ▲▲

—Frederic E. Lyford
Executive Director
Committee on Engineering Laws



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Connecticut Light & Power Co.
Devon Station . . . . . 50,000 sq. ft.
Georgia Power Co., Atkinson Station, 47,000 sq. ft.
Alabama Power Co , Units 1 & 2
Gadsden Station . . . . . 47,000 sq. ft.
City of Holland, Michigan . . . . . 13,000 sq. ft.
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Unit #1 Urquhart Station . 45,000 sq. ft.
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Unit #2 Urquhart Station . 45,000 sq. ft.
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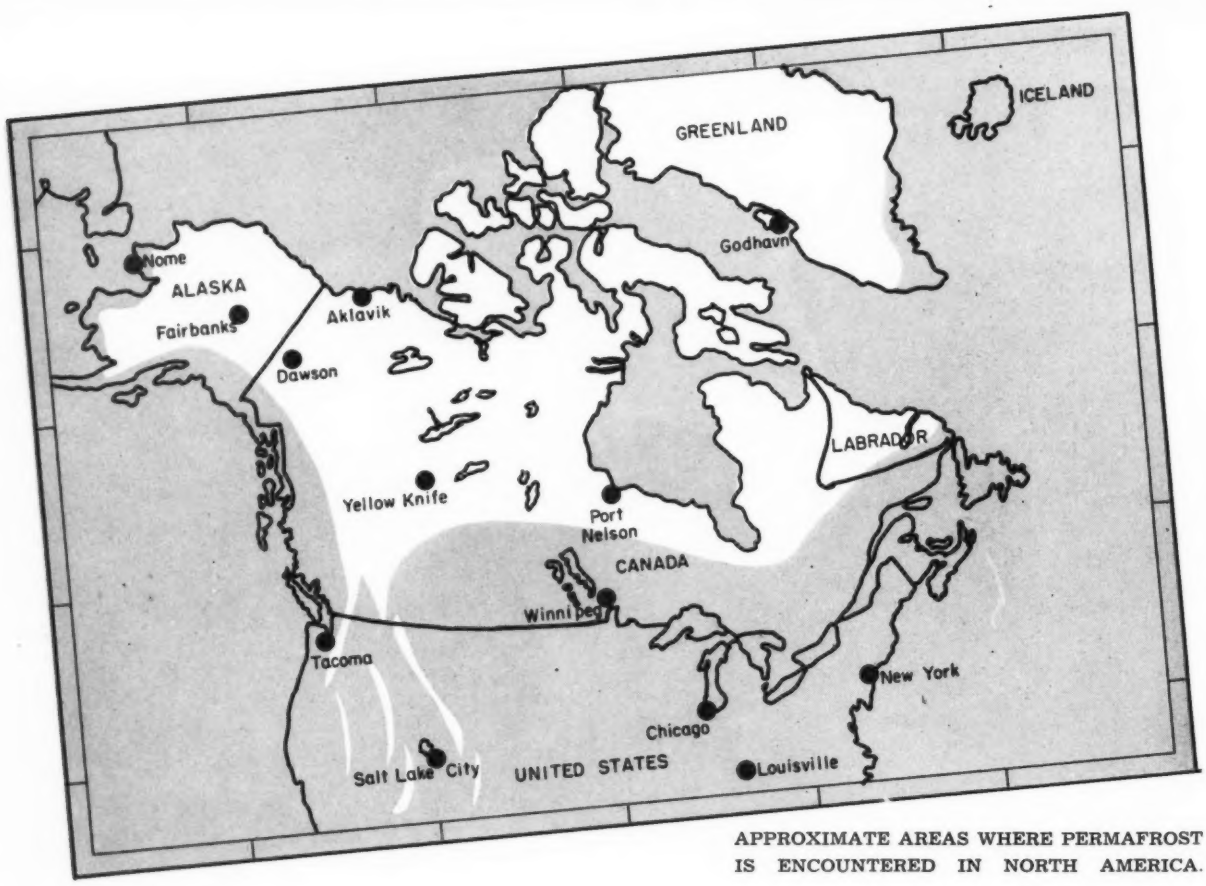


APPROXIMATE AREAS WHERE PERMAFROST IS ENCOUNTERED IN NORTH AMERICA.

The Consulting Engineer In Arctic Operations

JOHN S. G. SHOTWELL, Consulting Engineer

CE exclusive

John S. G. Shotwell, a partner in the consulting engineering firm, Nebolsine, Henderson & Shotwell, holds the degrees of Bachelor of Science in Chemical Engineering and Master of Science from McGill University and Doctor of Philosophy from Columbia University. He began studying the Arctic in 1920 while employed as an engineer by the Canadian government. During construction of the Greenland Bases in 1952 and 1953, he was Chief of Construction Management of the Northeast District of the Corps of Engineers. Since leaving the Department of the Army, he has been engaged in private practice and has devoted considerable time to the study of Arctic problems.

CONSULTING ENGINEERS engaged in Arctic or sub-Arctic operations must be well acquainted with the effects of Arctic weather on men, materials, and equipment, in addition to being competent in the strictly technical realm characteristic of Stateside projects. In addition to the northern terrain, he must be able to evaluate and overcome "permafrost," the permanently frozen ground that occurs in various thicknesses and conditions at various depths below the surface.

He must also be an expert in the supply of distant operations and especially in the peculiarities and limitations imposed by Arctic transportation. During the past two decades more than $2 billion have been wasted through the employment of methods very suitable for Stateside operations but totally unfit for use in the Far North.

The need for re-evaluation of the role of the consulting engineer in Arctic operations is intensified by the greatly increased activity in the North due to mining, metallurgical, and industrial developments, and expanding military construction.

The popular press and the movies have made much of the Arctic's low temperatures in winter,

as if this was the worst problem to be overcome. It is true that the temperature occasionally drops to 50 or 60 degrees below zero, but it does the same in some places in the United States. In fact, the average mean temperature in the winter is comparable to many Northern States.

The worst features of the Arctic winter are the three-month-long night and extremely high winds that accompany the low temperatures. The long night raises many peculiar morale problems that must be taken into account during the engineering planning; the winds require use of specially designed buildings and special precautions during construction and operation.

Most of the American Arctic and sub-Arctic is very rugged and barren. It consists of hills covered with snow most of the year and rivers, flowing through deep valleys, which become raging torrents with the spring thaws. The remaining terrain consists mostly of "muskeg," the dread Arctic swamp that is perpetually frozen a few feet below the surface and is the breeding place for the millions of deadly Arctic mosquitoes and blackflies. It is a forbidding and cheerless country.

Permafrost

While the inclement weather and rugged terrain have undoubtedly retarded the development of Northern Canada, Alaska, and Greenland, permafrost has done much more. Improper use of this permanently frozen sub-soil has caused more structures in the Far North to fail than all other causes combined. Failures of permafrost sub-bases have caused the relocation of whole towns, the collapse of buildings, and the complete failure of roads, railroads, and airfields. On the other hand, properly evaluated and used permafrost has assisted in the rapid completion of several Arctic projects.

Permafrost is a layer of soil, or rock, whose temperature has been below freezing for many years. It exists at varying depths below the surface and varies in thickness from a few inches to 1300 feet. It must be evaluated strictly on the basis of its temperature and not according to its composition, texture, water content, hardness, or toughness. It may exist as a continuous layer or only as lenses within the unfrozen materials.

Permafrost is solid and possesses good compressive strength and bearing characteristics when frozen. It loses strength when thawed, however, and the resulting silt and ice will not support structures. In fact, the characteristics after thawing may vary from point to point under a single structure, thus resulting in uneven settlement.

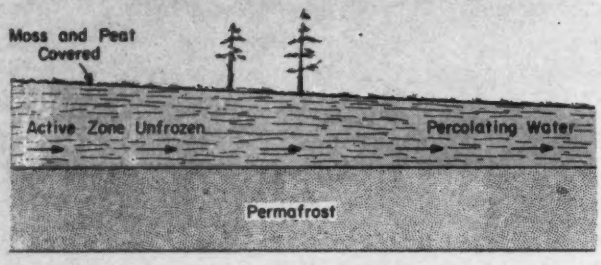
The Thermal Regime

The upper surface of the permafrost is called the "permafrost table". It is covered with ground, called the "active zone," that alternately thaws and freezes with the variations of the weather. The permafrost table occurs where there is a natural thermal balance and it neither breaks down nor builds up. This natural equilibrium is called the "thermal regime."

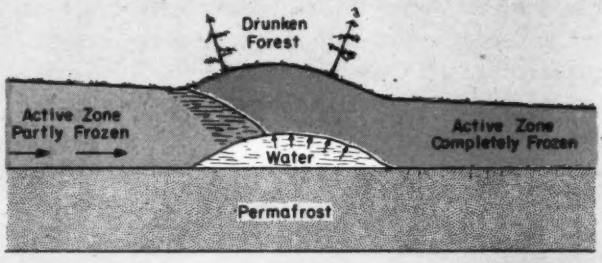
As a rule, disturbances in the natural equilibrium occur when man alters the surface conditions or removes the covering active zone. Increasing the thermal input into the active zone will cause a change in the thermal regime and the permafrost table then lowers. On the other hand, the construction of a large cold-storage plant might well decrease the thermal input of the surface and raise the permafrost table, causing the ground to rupture.

Ground water and the permafrost are normally in a state of equilibrium, with the water flowing

BECAUSE OF SETTLEMENT CAUSED BY BUILDING HEAT PENETRATING DOWNWARDS TO THE PERMAFROST, THE CANADIAN GOVERNMENT IS MOVING THE TOWN OF AKLAVIK, AT THE MOUTH OF THE MACKENZIE, TO A NEW SITE.



DRAWING SHOWS RELATIONSHIP OF ACTIVE ZONE AND PERMAFROST. GROUND WATER IN UNFROZEN ACTIVE ZONE PERCOLATES FREELY DOWN SLOPES.



FREEZING OF THE ACTIVE ZONE DAMS UP GROUND WATER ON THE SLOPES, CAUSING HYDROSTATIC PRESSURE TO PUSH UP THE GROUND SURFACE.

over the permafrost layer without changing its size, condition or shape. However, if the flow or temperature of the ground water changes appreciably, it will disturb this equilibrium. For instance, any material increase in the flow or temperature of the water would melt the permafrost and cause the active zone to settle. On the other hand, any great decrease in the water's total heat would cause the permafrost layer to build up until it finally ruptured the ground or structure above it. The Russians have reported that such action has snapped the strongest pile foundations and ruptured massive masonry, reinforced concrete, and timber structures.

Permafrost Failures

The Western world's first failure due to permafrost was in 1670 when the British attempted to construct a fort and trading post at Churchill on the west side of Hudson Bay. The expedition arrived at the site in late July and the men immediately began construction of the new post. They removed the tundra until they hit the rock-hard permafrost below. This resisted their tools, so they thought that they had reached solid rock. They simply leveled beds for heavy timber sills and proceeded to erect the wooden buildings. To keep warm, they maintained fires in the buildings. The heat penetrated downward to melt the permafrost, turning it into a semi-fluid ooze. This flowed out from beneath the sills and caused the buildings to settle, tilt, and crack until a flue opened and sparks set fire to the tinder-dry wood causing a conflagration that destroyed the whole establishment.

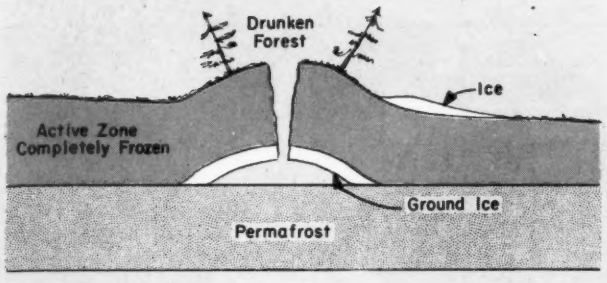
Permafrost caused continuous trouble during the construction of a railway terminal and port at Churchill during the early part of this century. Settlement due to permafrost has caused the collapse of buildings in Dawson, Whitehorse, and Fairbanks, and even by the mid-thirties, when the trading post of Yellowknife became a bustling mining town replete with smelters, repair shops, houses, and hotels, this problem had not been solved. The engineers built the buildings on piles, but they enclosed the space between the floors and the ground and did not insulate the floors. The result was that building heat penetrated downwards. By 1938, the settling was so great that the whole town was moved to a new location. This time the engineers selected a site where the foundations rested either on solid rock or upon a deep bed of well-drained, non-frost-acting gravel.

This year, the Canadian government is moving Aklavik, at the mouth of the Mackenzie, to a site 12 miles away because the whole town has been disappearing into the Arctic mud. Geological tests showed that the permafrost here consisted of 50 percent ice crystals, and the remainder was a fine silt. The building heat penetrating downwards melted the ice, thus causing the houses to settle. The new site is a well-drained gravel hill. It not only is free from frost action, but also permits the installation of a water supply system.

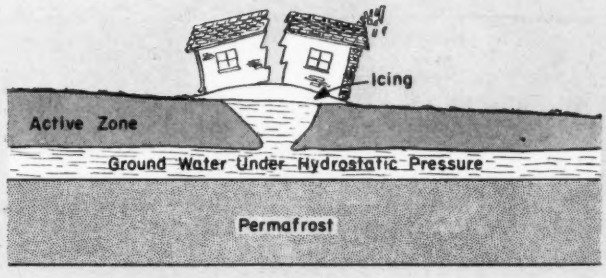
The solution to the permafrost problem sounds simple—select a site with solid rock or a deep bed of well-drained, non-frost-acting gravel under it, and insulate the floors so that no heat travels downward. This is fine in itself, but usually such sites do not occur where the operation in question must be carried out. If they do, the permafrost problem still exists with respect to the construction and maintenance of access roads. Furthermore, there is no perfect insulation at the present time. Some compromise must therefore be made.

Drainage

The preparation of an Arctic site requires very special attention and experience. It must be provided with drainage so that the ground water does not interfere by disturbing the thermal regime or causing the permafrost to swell or settle. Next, the cover and upper permafrost layer must be removed down to the solid permafrost; then the sub-base, base, and foundation must be designed and constructed so that there will be no settlement or shift



MOUND IS RUPTURED BY HYDROSTATIC PRESSURE AND CRYSTALIZATION OF ICE. OCCASIONALLY A HOLLOW SPACE IS LEFT IN CORE OF MOUND.



WATER COMES TO THE SURFACE WHEN ACTIVE ZONE THAWS. UPON EXPOSURE TO THE COLD AIR IT FREEZES, CAUSING ICING AROUND BUILDINGS.

if more permafrost melts. Finally, the floor must be sufficiently insulated from the fill and foundation to prevent the transfer of heat through the foundation and fill to the permafrost.

The drainage of the area is not as simple as it sounds because the muskeg exists as wet material over the permafrost and is contained in a continuous series of rocky basins that naturally prevent either local or general drainage. In the early-eighties John McCoun suggested, in a report to the Canadian Department of Agriculture, that channels be cut through the rock walls and that canals through the muskeg be used to drain the water to the nearest river. Nothing had been done along this line until General A. G. L. McNaughton began the construction of a series of airfields across Canada as a relief measure in 1930. He found that by following this suggestion he was able to satisfactorily stabilize the muskeg so that he could erect emergency landing fields upon it. Some of these have since been converted into operational fields for heavy aircraft.

Substructures

There are three types of substructures that may be used: piling, excavation down to the permafrost and fill with non-frost-acting material, and a combination of the two methods.

Piling may be satisfactory, provided there is sufficient cover over the permafrost to insulate it and provided the solids in the permafrost are non-frost-acting gravel. That this is difficult is shown by the experiences at Aklavik and Yellowknife.

Another factor to be considered when using piles is the danger of ice forming on the permafrost and shearing off the piles. Since it is impossible to drive piles into permafrost, the most successful method for setting them is to drill holes into it, place the piles, fill the holes with slurry, and then allow the piles to freeze in place.

The excavation of all cover down to the permafrost and subsequent filling to the finished grade with well-compacted, non-frost-acting materials is an excellent method if the fill is of sufficient depth to thoroughly and completely insulate the permafrost from all building heat losses. Furthermore, the drainage must be good, and the thermal regime must not be disturbed during construction.

It is difficult not to disturb the thermal regime since, if the weather is relatively warm when the permafrost is exposed, the upper layer will melt. If warm fill is then placed on the disturbed permafrost, a still greater disturbance will take place. Using cold aggregate for the bottom courses and laying them during cold weather with the rest backfilled later is one way of meeting this difficulty. Experience has shown that at least 8 feet of fill and preferably 15 feet are necessary under ordinary buildings. Thirty feet is the minimum under buildings with high heat losses.

The combination of piling and deep fill gives promise of being the best sub-structure. Here, the piling takes the main load while the fill takes the secondary loads and acts as an insulator.

The foundation proper may be of two types, but in any event it must provide at least an 18-in. air space below an exceptionally well insulated floor. The first method is to use frame timbering with one set of heavy timbers running laterally and the second set longitudinally. The second method is to pour a concrete slab on the sub-foundation; then place sheet metal forms or piping on this slab and pour another concrete slab on top of these. With either design, the foundation should be surrounded with a light wall that will prevent the admission of warm air during the summer but can be opened to permit the free circulation of cold air during the winter. The floors should be constructed of two skins with a thick layer of insulating material between.

Supply and Transport

Supplies and transportation are other factors that the consultant on an Arctic job must take into consideration from the very first stage of planning and

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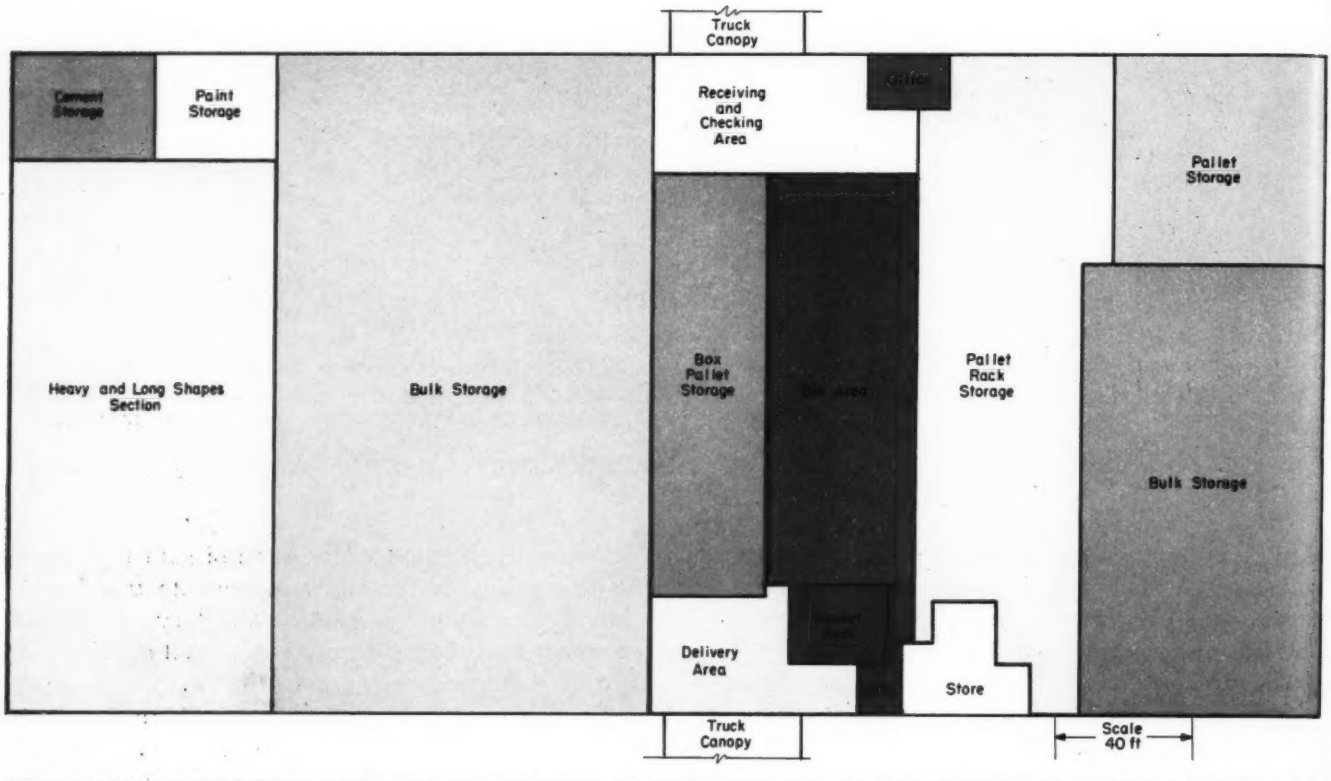


THIS LAYOUT REPRESENTS THINKING OF TOP-LEVEL MANAGEMENT AND OF CONSULTANTS IN MATERIALS HANDLING.

Materials Handling—— A New Concept for Consultants

JOHN DRURY SHEAHAN
Drake, Startzman, Sheahan and Barclay

CE exclusive

Mr. Sheahan is a partner in a consulting firm widely respected for its work in materials handling. His article advocates top-level responsibility for materials handling functions. His ideas, based upon his own firm's experience, should be of help to other consulting engineers.

THE OBJECTIVES in setting up any client's materials-handling organization is the same as in other functions: co-ordination and direction of line and staff specialists, and of operations in all plants. Co-ordination is a responsibility that cannot be delegated to levels below the client's top management. Because of departmentalization and geographical dispersion, middle-level client management cannot by itself isolate and solve a company-wide materials-handling problem. Where several departments or plants are involved, each sees only fragments of the problem, and thus can present only piecemeal solutions to it.

All too often, one man is in charge of materials handling in one place, another man in another place, a third for packaging, a fourth for traffic, and so on. Each is necessarily well down the organizational ladder, so far removed from the chief executives that there is rarely any communication between them. This is the usual pattern of organization a consulting engineer will find.

Coordinate at Top Levels

Materials handling consultants often find that the solution to a problem is not to change the handling alone, but to change the layout, package size, storage technique, transportation arrangement, or (more frequently than might be thought) the method of controlling materials. Materials control can sometimes eliminate complete handling operations. The best attack is to recommend that top

management co-ordinate these functions organizationally at the vice-presidential level.

There are four reasons for creating a "Director of Physical Distribution" at the vice-presidential level, and for giving him full responsibility for materials handling, warehousing, layout, packing, traffic, and control of materials.

Command Attention

First, he can command for these functions the top-management attention they deserve. He is in a position to speak up when sales plans might otherwise be formulated without consideration of transportation and warehousing, or when purchasing policies cause unnecessary handling and storage. With a voice in policy, he can make sure his company does not save money in one direction, only to lose it on distribution.

Second, a client can afford to put into this position a high-priced man and gain the benefits of correspondingly high quality performance.

Third, these functions become the responsibility of an expert. They are no longer "stepchildren," dispersed under executives who may be competent but whose interests and experience are in other fields.

Fourth, co-ordinated organizationally, these functions are co-ordinated operationally. They are integrated under a man who can see when a small change in packing will make a major change in handling, or when a new program is needed to tie traffic and warehousing together to save money in both departments.

A large soap-manufacturing company reorganized its entire distribution operation because it estimated that it could save a large sum by making one executive responsible for all physical distribution functions. He was given authority over handling, warehousing, and transportation of all raw materials until delivered to the production plant and of all finished goods until delivered to customers. The actual savings from this organizational change have been twice the original estimate. Recommending the establishment of a director of physical distribution proved the best solution to the problem of organizing materials handling and related functions for economical operation.

The need for control techniques—planning documents, organization charts, budgets, and progress reports—is not limited to policy-making executives. The controls will help each level of management make the best use of its resources. In materials handling, a well-planned control system raises productivity and improves service even though no money is spent on new equipment or facilities.

A Good Example

Such techniques as production control are just as applicable to materials handling as to production itself. Consider, for example, a plant in which shipments have to be closely timed in accordance with commitments to customers, carrier schedules, and other factors. Packing is the heart of the operation, but it is not controlled. There is no scheduling and no time standards. The foreman decides what orders to pack, the men decide how fast to work, and processing a routine order takes as much as ten days. The warehouse consequently is plagued by "expedites" and emergencies. In this instance, relatively new management is aware of the deficiency and wants to correct it.

A recommended control system begins with work measurement. Units of measure (orders, line items, pieces, or pounds) are established for each major activity such as receiving, packing, and shipping. Time standards (so many pieces to be packed per man-hour, so many pounds to be shipped per man-hour) also are established.

Establish Control

On the basis of the work-measurement system, the program proceeds in several directions. One is issuance of a daily report on actual and standard productivity to show where time is lost and where costs are excessive. Another is establishment of production control—with a length of time to pack each order, daily scheduling of orders to be packed, and the times at which each should be started and completed.

A control system like this paces an operation and increases the output of each employee. It shortens the processing cycle and makes possible advance determination of the shipping date so a definite promise can be made to the customer. It is a type of control familiar to production managers, but is generally unknown among materials-handling and warehousing people. Since it is intended for the intermediate levels, only a summary of the results need ever reach top executives.

Monthly Reports

The one indispensable tool for top-management control of materials handling is a monthly report from each plant and warehouse. The case history of one corporation helps to describe such a report. This company operates more than a dozen plants and 40 finished-goods warehouses. Imagine the extent of materials handling in that operation—the tonnage transported and stored every day. Yet there was no central control of handling. In fact, no systematic attention was paid to it.

A survey of one warehouse disclosed that improvements in storage and handling would halve the costs. Other warehouses were studied quickly, and the findings were reported to the company's management. It was pointed out that the savings at the one warehouse would be insignificant compared with savings that could be made by establishing an integrated handling system for the whole

DAILY WAREHOUSE PRODUCTIVITY SUMMARY

	Receiving	Checking	Storing	Picking	Making Boxes	Packing	Shipping	Rewarehousing	Total
Units (or pounds) handled	1,085	95	752	927	63	212	250	23	—
Actual man-hours expended	13.0	12.1	47.0	36.0	16.0	24.0	12.0	2.0	162.1
Actual hours expended per hundred pieces (or pounds)	1.2	12.8	6.3	3.9	25.5	11.4	4.8	8.7	—
Standard hourse per hundred pieces (or pounds)	1.0	7.6	5.0	4.0	22.7	12.6	4.6	8.6	—
Productivity (per cent)	83	59	79	101	89	110	96	99	—
Variance from standard (per cent)	-17	-41	-21	+1	-11	+10	-4	-1	—
Actual man-hours available	24.0	16.0	56.0	40.0	16.0	32.0	24.0	—	208.0
Total man-hours expended									162.1
Total man-hours available									208.0
Overall man-hour utilization -- per cent									78

By _____

RECORDS SUCH AS THIS HELP ESTABLISH AND FOLLOW UP A SENSIBLE PROGRAM FOR ORGANIZING DISTRIBUTION.

company—with central control of handling, packing, and shipping of the product from the end of production lines to customer delivery.

For example, the manner in which a plant outloads its product, and the degree to which it makes an orderly load and protects it against damage in transit, have a profound effect on receipt and handling at destination. The product of this company is susceptible to damage in transit. Some plants had reported carloading methods that proved successful, but there was no clearinghouse for this information.

Transfer of stock between warehouses was excessive. This added to transportation costs. Even worse, the method of shipment from one warehouse was completely unrelated to the problem of receipt at another. There were differences in materials-handling, warehousing, and shipping practices at each plant and warehouse. No effort had been made to determine which of the practices would be the best for company-wide application.

Standardization of procedures promised three advantages: efficiency of local management would be increased if it were below standard; each local management would be prepared to handle loads received from any other; and uniformity of practice would facilitate supervision and co-ordination by the central office. A corrective program was recommended to top management.

The first step was to set up in the company headquarters a co-ordinator of warehousing, materials handling, and shipping. Second, theoretical warehouse layouts—based on varying levels of inventory and activity—were devised. These serve as standards for new construction and measurement of warehouse space requirements. There formerly was no uniform policy for determining space requirements; the type and amount of space had been decided by local custom and preference.

Third, a master list of warehouse equipment, both mobile and fixed, was developed. Once the purpose of a warehouse is described, the central control office can determine from this list whether requests for equipment are proper.

Fourth, standards of productivity were established to serve as a guide for setting up manning tables. Fifth, a training program for supervisory personnel was set up. Finally, a warehouse reporting system was worked out.

The reporting of four types of data should be recommended. It is important to be specific and detailed on this point, because most large companies can profitably use a basic form of this report with only minor modifications.

Begin with space. Find out the volume available and how it is allocated. The report should show total volume, how much of the total is used for storage, and how much is used for other activities. It should show how much of the warehousing volume is unusable because of obstructions like columns and elevators, how much is in aisles, and

how much is allocated to receiving, packing, and shipping. All measurements should be actual, not estimated. Know the extent to which present storage space is utilized; the report should indicate the percentage occupied and percentage vacant.

The second important type of data covers equipment. The number of major pieces of equipment should be reported, including the number out of service. Equipment operating costs also should be reported, especially costs for fuel (or power) and for maintenance.

Third, data should show the number of employees, their hourly rates, and the straight and overtime man-hours by such categories as foremen, assistant foremen, warehousemen, lift-truck operators, packers, and maintenance men. Fourth, the quantities of materials received and shipped should be reported.

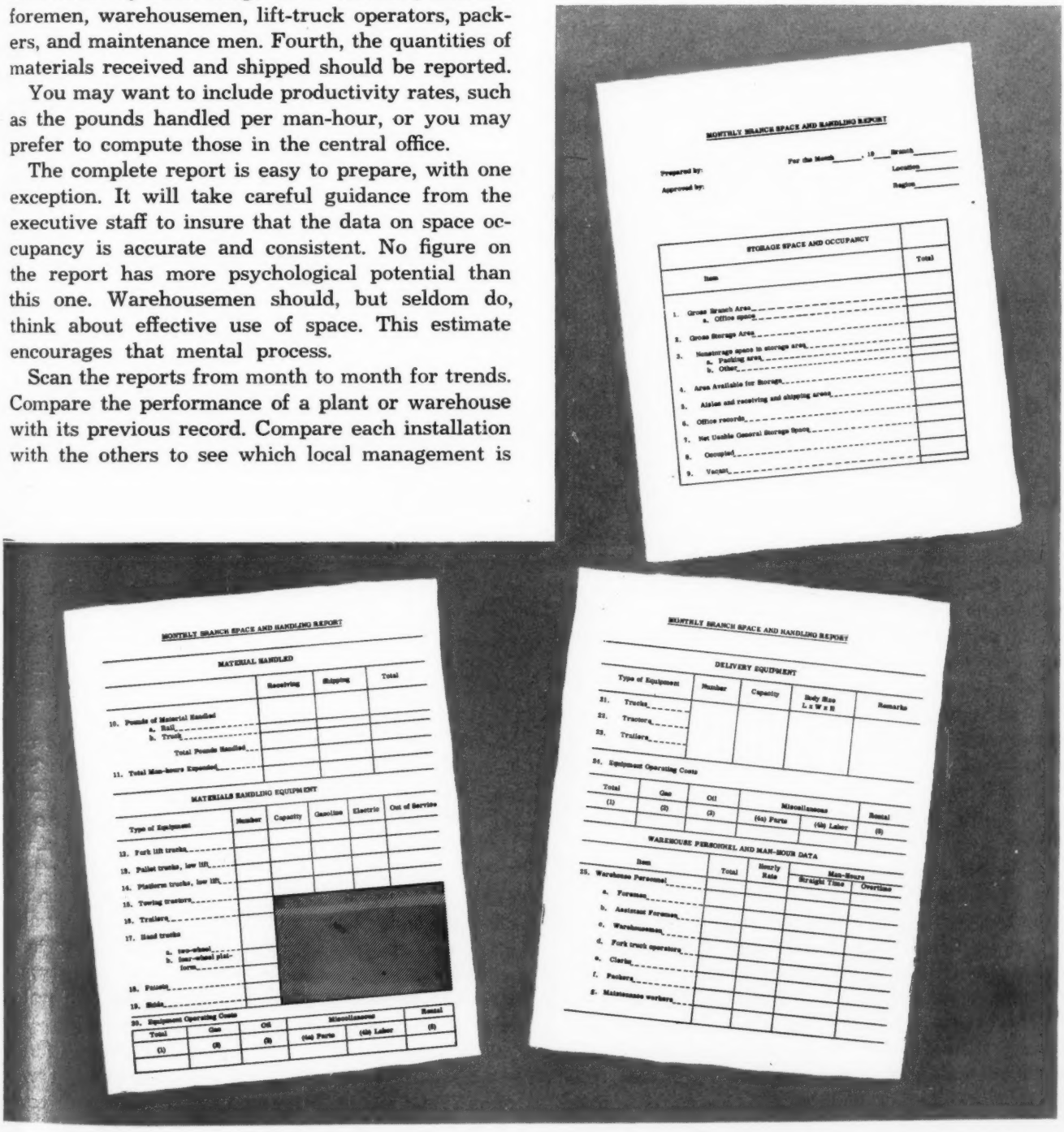
You may want to include productivity rates, such as the pounds handled per man-hour, or you may prefer to compute those in the central office.

The complete report is easy to prepare, with one exception. It will take careful guidance from the executive staff to insure that the data on space occupancy is accurate and consistent. No figure on the report has more psychological potential than this one. Warehousemen should, but seldom do, think about effective use of space. This estimate encourages that mental process.

Scan the reports from month to month for trends. Compare the performance of a plant or warehouse with its previous record. Compare each installation with the others to see which local management is getting the highest production per man-hour, which is making the best use of equipment, and which is storing and handling the most materials per cubic foot of space.

If materials handling is to be controlled, these classes of data are as essential as a sound organizational structure. But these are not enough. The third prerequisite for control concerns methods and layout.

The monthly report tells whether the amount of money or manpower expended on materials handling is large, but not whether it is too large. It


MONTHLY BRANCH SPACE AND HANDLING REPORT
STORAGE SPACE AND OCCUPANCY
MONTHLY BRANCH SPACE AND HANDLING REPORT
MATERIAL HANDLED
MATERIALS HANDLING EQUIPMENT
MONTHLY BRANCH SPACE AND HANDLING REPORT
DELIVERY EQUIPMENT
WAREHOUSE PERSONNEL AND MAN-HOUR DATA

SYSTEMATIC ANALYSIS OF WAREHOUSING SPACE AND EQUIPMENT IS POSSIBLE THROUGH USE OF THESE FORMS.

tells what the performance of a plant or warehouse is, but not what it should be. It tells whether a plant or warehouse is doing as well as it did in the past or as well as the others, but even the best of these plants may be inefficient.

The only acceptable yardstick for measuring present performance is the best possible performance. The way to judge the efficiency of a method is to see if a better one can be developed. On the basis of time and motion studies, the improvements recommended and the standards set, it can be determined what the cost and efficiency of materials handling should be—not merely what it is.

People in materials handling have sometimes tended to think almost exclusively about equipment. They have been dangerously close to becoming gadgeteers. But the trend is away from that. One of the signs that materials handling men are becoming more mature is the new emphasis being given to methods and layout.

Finally, the consulting engineer should be encouraged not to isolate materials handling but to relate it to warehousing, layout, packing, traffic, and control of materials. He should be encouraged to think about physical distribution and the interdependence of all these functions. ▲▲

A Testimonial To Consultants

"With an expected loss of government contracts at the end of the Korean situation, we decided we needed a new product for our commercial business. A letter was sent out to all of our distributors with a list of about 20 products that were already on the market that we believed we could make. They were asked to list, in the order of their preference, the four products they believed would sell best. When the results came back, they strongly indicated that a rotary trowel for finishing concrete would be the best item.

"The big problem then was this: who would design the trowel? To a large concern with many engineers, this would be no problem. However our distributors wanted this machine in a hurry. If we designed the trowel ourselves, we would have to take on extra engineers since our present small staff was kept constantly busy with their regular work. If we got an outside firm to do the job, they could do it faster, but it would mean a large outlay of cash and we would not have the close supervision of the job that we could have if we did it ourselves.

"We decided to contact several outside firms to see what they would charge. One concern, Designers for Industry, suggested that we have them make a "technical survey" before going into the design of of the machine. We would not be required to give them the design job after the survey was finished.

"We decided to go ahead with the technical survey. It was started November 4, 1953. Beside their own patent study, the technical survey team was to come up with an estimate of sales, the over-all picture of competition (including the advantages and disadvantages of competitors' machines), new features to be included, and an acceptable price.

"The survey was made by interviewing competitors' distributors and contractors. Detailed questions were asked about the product and about improvements thought necessary. As an independent designing firm, DFI had no trouble getting the information. This information was very useful, not only in confirming our estimate of the potential market, but in the actual designing of the product.

"A preliminary report on the survey was submitted and a conference was held at Stow on January 6, 1954 to discuss the results. After considering the discussion, we decided to give the design job to Designers for Industry.

"We prepared a list of features to be considered by DFI in the design. These were constructive rather than restrictive. They were based on the technical survey and comments by our distributors. We left the design wide open to DFI, merely saying that we wanted a machine superior to those then on the market, and one that could be manufactured to sell at a competitive price. By not restricting the design, we hoped to get many new, fresh, novel ideas. DFI estimated they could complete the prototype in 90 days.

"Six weeks later a conference was held in Cleveland to discuss the preliminary design. We suggested a few design changes. Authority was given to DFI to prepare assembly and layout drawings based on the preliminary design and the changes. Another meeting was held 10 days later.

"The prototype was completed and shipped to us. It arrived on April 29th. Testing on a slab was begun immediately. The prototype was compared with competitors' models on the same job. As a result, some changes were made in the machine.

"At this point we decided to do the production drawings ourselves rather than let DFI do them as was originally planned. We believed we could make the drawings quicker, since we knew just what production machines we had. All work was terminated immediately with DFI. The total paid to DFI, including the survey, was $10,607.78.

"We believe that by using an outside design firm we not only obtained an excellent design, but we obtained it much quicker than by doing it ourselves."

C. Hotchkiss Jr., Sales Department
Stow Manufacturing Company

CE exclusive

Expense Accounts -- A Pay as You Know Plan

STAFF ARTICLE

EXPENSE ACCOUNTS are as much a part of a consulting engineer's overhead as drafting room charges, and yet rarely are both looked at with the same critical eye. The costs of travel continue to go up. The pressure to hold operating costs down continues to grow stronger, too. How can travel costs be held in reasonable check without howls of penny-pinching from the men who have to travel? How is it possible to critically analyze a man's account without impugning his honesty?

The answer lies in establishing sensible supervision in place of slipshod, sporadic economy drives. If company policies are made explicit and well known to its traveling personnel, all reviews of expense accounts can be made by measuring against company standards instead of measuring against the man himself. Too few companies let their men know exactly what is expected; too few traveling men really understand how far the firm wants them to stretch the expense-account dollar. The anomaly is that the traveler really wants—for his own peace of mind—to have firm ground established upon which out-of-town living standards can be based. And most important—each man would like to know that his colleagues are allowed the same latitudes.

Train or Plane?

What should company policy be? It could begin by considering modes of transportation. Should it be car, train, or plane? Of course, there is no pat answer. Time is one factor; schedules and appointment commitments might rule out all but the plane. But the men should know how the firm feels about using Pullmans, parlor cars, extra-fare planes and trains, and coach flights. These are areas where options exist and the company's tastes should be made known. And the men should know to what extent personal preferences will be recognized in choosing modes of travel.

A good practice is to keep up-to-date hotel direc-

tories, rail schedules, and an *Official Airline Guide* in the office to forestall last minute telegraphing for reservations. This can put the brakes on the man who always has to take a drawing room on the train because the roomettes had all been sold out. (He's the same one who winds up in the bridal suite because the hotel always seems to be out of singles-with-bath by the time he gets around to making reservations.)

Which Hotel?

The matter of hotel selection is another of those items where foreordained company policy can put everyone on a well-rooted base. Certainly, even the most conservative business man wants his men associated with a better grade of hotel than the shoddy roominghouse variety that happens to cater to transients. And those plush American-plan resort hotels should probably be off-limits for the most part, too. The only exception, and a good general rule at that, is that your man should stay at the convention hotel when he's attending a convention. Reduced taxi fares and the value of increased contacts will more than pay for any unusual luxury that might attach itself to such a policy. In general, commercial hotels of the standards set by the nation-wide chains are usually the best bet. No firm would go wrong in letting their men know that such should be their home away from home.

When a man takes his wife along (and he should know the company policy on this), should he split the room bill down the middle with the firm or can he assume that the company will pay his single-occupancy rate regardless, leaving him to pay only the additional charge for double occupancy? This may appear to be a small matter in an individual case, but the dollars involved could become significant in a firm with many traveling men and with a firm that likes to see wives go along to help hold up the social end of the company's affairs at conventions and meetings. The important thing is that the company should know what it wants done and should make its men toe the line once the line is drawn for them.

Telephone Home

Some firms allow a long-distance call home for every two or three days out. Some firms don't. But why not let the boys know what is considered cricket so they won't be tempted to chisel the call anyway?

Perhaps the fundamentals of the problem rest with establishing a basic philosophy among many alternatives: should the traveler be allowed to charge all out-of-pocket expenses, should certain personal expenses (haircuts, laundry) be allowed during a trip at intervals pegged to the number of days out, should the traveler be allowed to live it up to the limit of his conscience (or his company's good nature), should he "live the way he lives at home," or should some uniform standard of living be established for all men on the expense account? No firm wants to support the boys in a "style they'd like to become accustomed to," nor does it want to give visited parties the impression that the firm's last penny is being spent to send its man on this particular trip.

Personal entertainment is generally not considered a company expense, but entertainment is allowed for all concerned when clients and prospects are being made "favorably disposed" to the home office. Internal company policy and conditions indigenous to the trade will dictate the norms for entertainment. Engineering firms, in particular, are not generally required to be big entertainers. Soundness and conservatism of the type associated with engineering do not go well with lavish spending.

Be The Guest

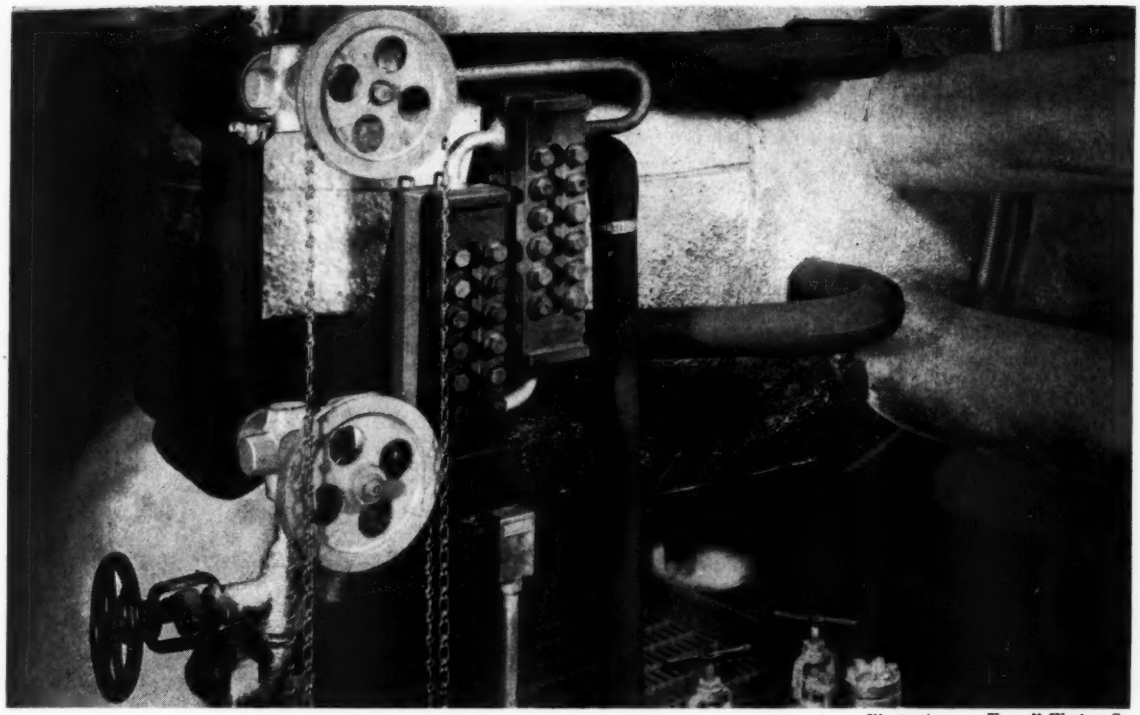
A great feature of human nature is often overlooked. A greater sense of self-importance is usually generated by being "host" than by being "guest." People feel more kindly toward the man who lets himself be a guest at home or at a club, than does the prospect who is burdened with obligations foisted upon him by the freewheeling entertainer. Certainly, each prospect has to be sized up individually. Moderation is always a good answer. But traveling men should know how far the accountants at home will back them up without quibbling after the trip is history.

It is a good idea to provide frequent travelers with certain basic credit cards. An airlines travel card is very helpful; it is widely accepted as a credit reference. Universal hotel credit cards and credit cards for the major hotels are very convenient. Auto-rental agency cards are a third class of useful credential.

Internal Revenue

The Internal Revenue Department has an interest in expense accounts, too. Generally, they prefer a maximum of detail in reporting deductible items and in attaching receipts to expense accounts. They want data to show that deducted expenses are reasonable and necessary. This works hand-in-hand with sensible company policy.

To question a man's expense account on an indiscriminate basis, with no clearly defined company policy against which to measure, is to reflect on the man's honesty and loyalty. By such tactics, the firm can lose more than it would gain in dollar savings. Belligerence follows closely on the heels of such ill-founded stabs at economy. For everyone's good will, and for a sense of fair play, the best thing is to get up a policy, make it known to new men as they come in, and be sure that the old-timers remember it as long as they travel. ▲▲



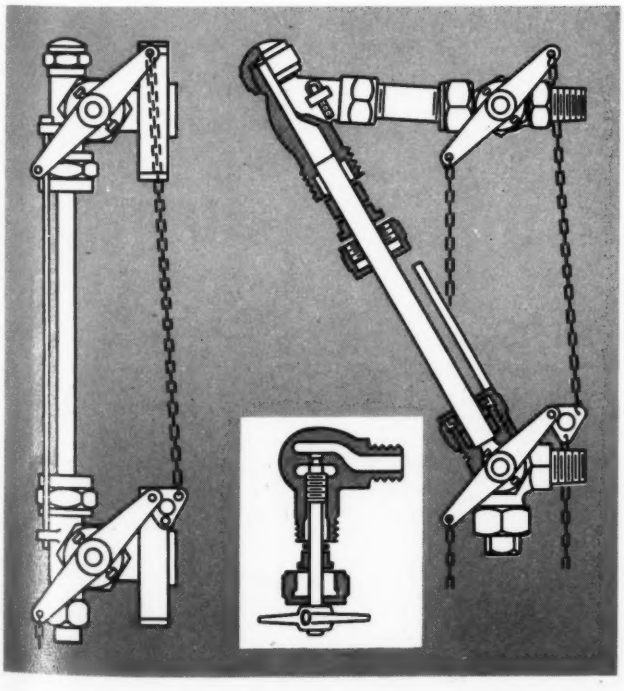
Illustrations — Yarnall-Waring Co.

SEPARATED DESIGN, DOUBLE FLAT GLASS INSERT—CIRCULATING TIE BAR WATER GAGE ASSEMBLY

Gage Glass to TV Tube

CE exclusive

R. E. DERBY, A. C. Wood Associates
and
F. PTACEK, Yarnall-Waring Company



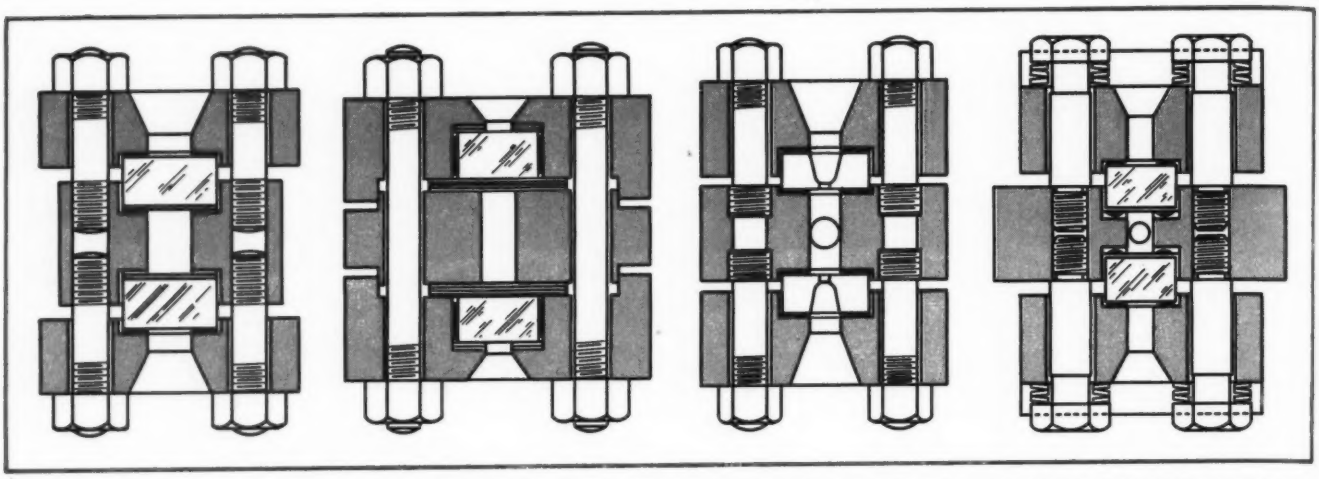
VERTICAL AND INCLINED TYPE ROUND GLASS GAGES.

IN ANY STEAM generating plant, boiler water level is of paramount importance. Even minor variations can impair performance while extreme high or low water conditions can cause serious damage. Thus, the boiler water level gage is indispensable because it performs the vital service of providing the continuous, accurate, reliable, visual indication of water level that is required for safe, efficient operation.

Development of Boiler Water Level Gages

When the first central station boilers were installed, and for a period thereafter, the vertical, round glass gage proved sufficient. Since most boilers were low in height, the gage was readily visible. Glass life was good at the usual pressures of 125 to 200 psig.

With the advent of larger single unit capacities and steam pressures to 400 psig, the over-all height of boilers increased, making the gage glass less visible. In addition, gage glass life was reduced. The visibility problem was solved by using an inclined gage with the valves placed close to the water col-



L TO R: CONVENTIONAL, LOOSE WINDOW, MICASIGHT, AND FLOATING ASSEMBLY-PRESSURE SEALED FLAT INSERT GAGES.

umn to permit a clear view of the meniscus. Difficulties with wear were partly corrected by sloping the top connection to flow condensate back into the column and prevent glass erosion. Although the stem threads of a typical gage valve were exposed to steam and water, and the bronze body also served to make the seat, the service life of the inclined gage was considered good. Field experience, however, proved that the application of tubular type glasses should be limited to 400 psig pressure.

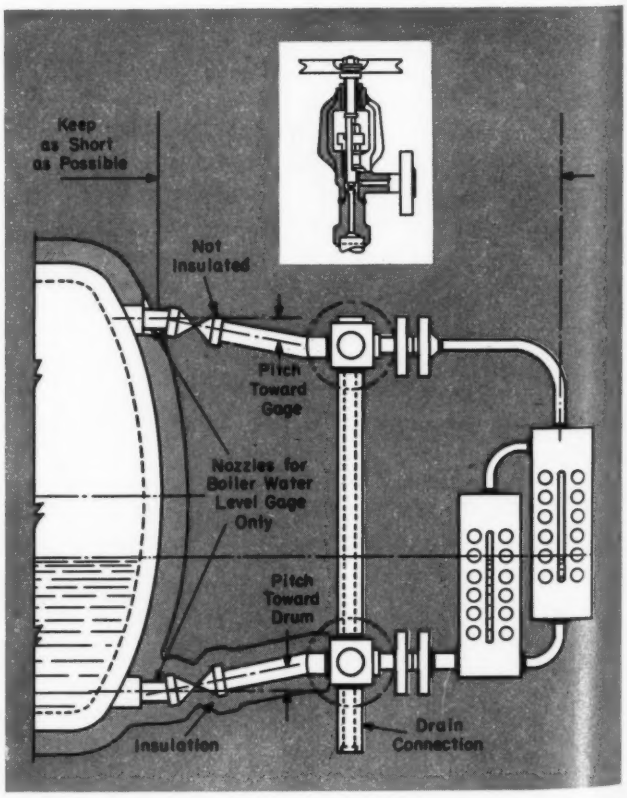
Constantly increasing pressures soon led to the introduction of the flat glass insert type of water level gage. The first design, developed for boilers operating at 500 to 600 psig, offered mica-protected glasses held in place by heavy covers attached with studs and nuts. The construction required care in assembling to prevent uneven and undue loading of the glass in spite of the cushion gasket between the glass and cover. Some units are still in service.

Between 1927 and 1938 operating pressures went to 1200 psig and a little later, temperatures to 900 F. For these conditions (and higher pressures) the loose window construction proved suitable. With this design, instead of clamping the glass tightly between the cover plates and body, the glasses are bolted in place so that they remain loose. The steam joint is made by clamping gaskets and mica between the body and the projecting surfaces of the cover plate surrounding the glass.

Another design, effective for pressures up to 2000 psig, eliminates the glass inserts entirely. A substantial forged steel insert body is used to hold two windows of selected mica securely under slotted cover plates, fastened by bolted clamps. It is claimed that mica is a flexible material that will bend but will not break or blow out when properly assembled.

In the pressure range to 2500 psig, the floating assembly, pressure sealed insert construction is suitable. This design features a special molded heat resistant gasket (reinforced) fitted into a stainless steel recess in the body, and shouldered cap screws with stainless steel spring cones to assemble the cover on the body. Selected mica —0.015-in. thick — protects the glass, and the glass itself possesses a maximum amount of resistance to boiler water chemical attack (in case of mica failure) and will "fail safe" with an interlocking type of fracture. With some assemblies, the glass inserts are sectionalized or divided into a series of individual windows.

Currently, the tendency in high pressure gage design is toward replacing the water column with a one-piece circulating tie bar with integral flanged connections. The lower flanged connection to the insert assembly eliminates the usual cold water leg



INSTALLATION SUGGESTIONS FOR CIRCULATING TIE BAR—FLAT INSERT HIGH PRESSURE GAGE ASSEMBLY

(assuring greater accuracy of gage reading), and also a stuffing box. The upper flanged loop connections between insert and gage valves allows for expansion and contraction of the various components. A tie bar, in addition to being the link between gage valves, provides a circulation to keep the gage hotter, and acts to some extent as a condensate guide.

One-piece, high pressure gage valves are used with the double pressure sealed, flat glass insert — circulating tie bar assembly. The nozzle with integral stellite seat is welded to the body, making a one-piece construction. For 2500 psig the valve disc is rolled on and stellited. Both the outside yoke bushing and the stuffing box are of a generous length to assure long wear.

Gage Illumination

Low boilers, using round glasses, frequently do not require special gage illuminators, but when they are necessary, one or two bull's-eye indicators, properly located, will suffice. For the higher pressure, flat insert units, however, gage illumination is an absolutely essential requirement.

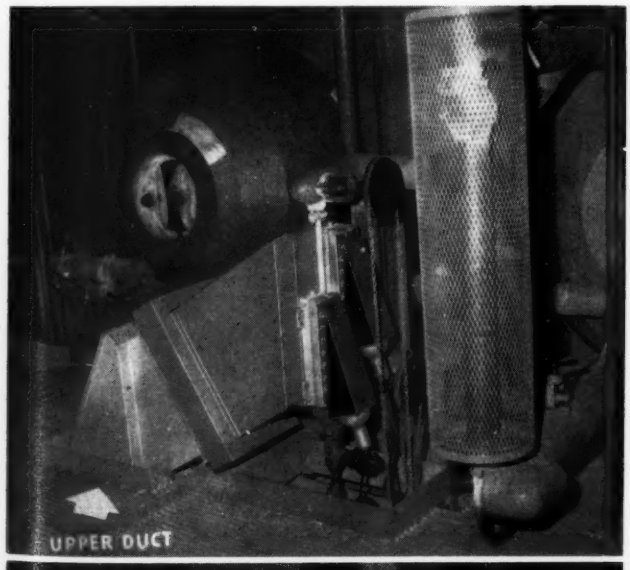
One common method —a 150-watt clear incandescent bulb in the bottom of the housing, below the lowest water level visibility — has been used for years. A more recent type uses a 100-watt mercury vapor lamp because its rays provide superior penetration of turbid water, mica deposits, air borne dust, and extraneous light. The meniscus shows up as a brilliant spot regardless of its position over the entire visible portion of the insert. Other designs utilize light-refracting devices to produce contrasting colors in the steam and water spaces.

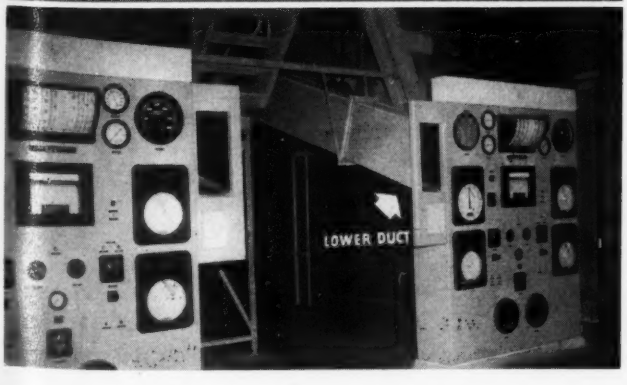
Mirror Transmittal

Structural interferences or the considerable distance from the gage to the operating floor on high pressure boiler installations often necessitate mirror transmittal of the water level. Two general arrangements are used, one with and the other without ducting. Systems with a mercury vapor illuminator and no ducting are suitable for total transmittal distances up to 125 feet. With a hooded mirror and duct-enclosed reflecting system, it is possible to exceed the 125-ft maximum. The lower mirror is on a floor stand with both swivel and vertical adjustments, and it can be placed some distance from the front of the boiler.

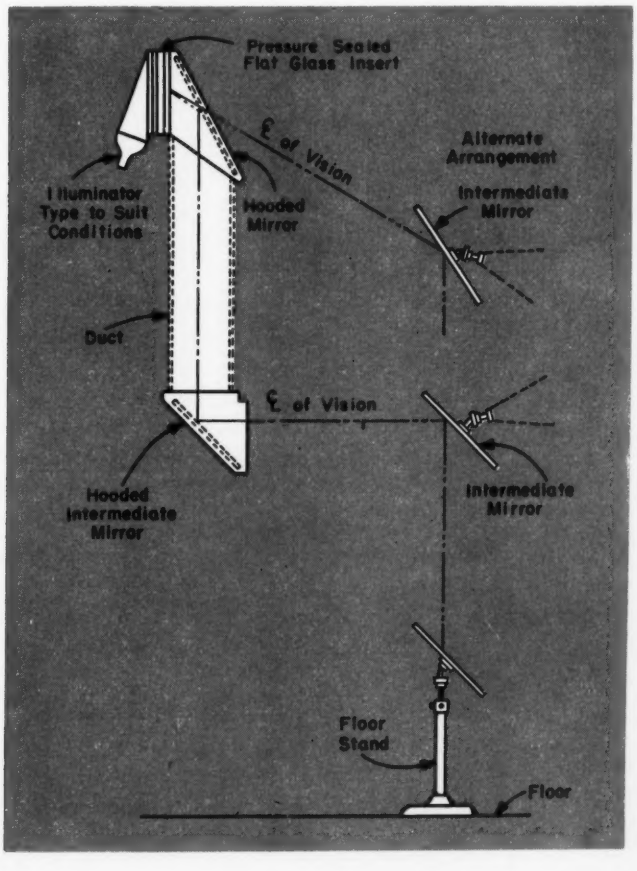
Television

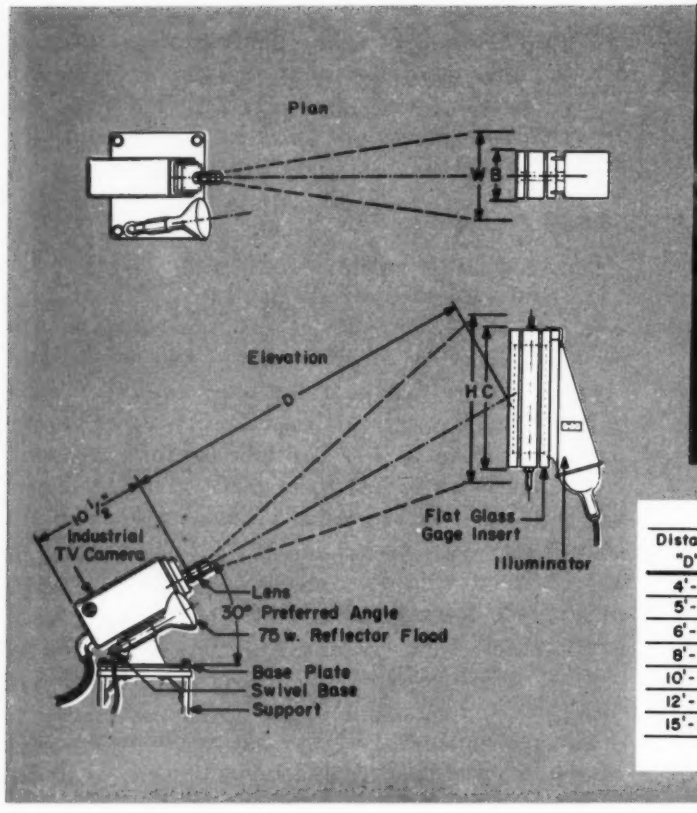
Many large high pressure steam plants use television to provide a remote indication of the boiler water level. A live, precise view of the gage glass is projected on the screen of a monitor installed in a convenient location. Simplified two-unit chain ar-

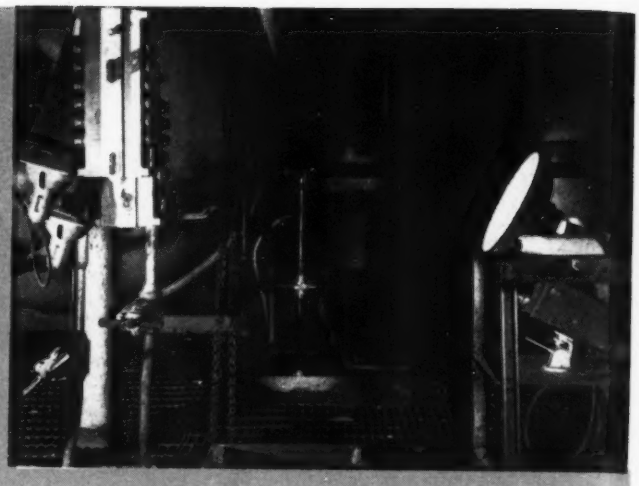




INSTALLATION PHOTOS AND SCHEMATIC DRAWING OF MIRROR TRANSMITTAL OF WATER LEVEL INDICATION.







Suggested Camera Distances

Distance "D"	13 mm (1/2 in.) Lens		25 mm (1 in.) Lens		51 mm (2 in.) Lens	
	Width "W"	Height "H"	Width "W"	Height "H"	Width "W"	Height "H"
4'-0"	36"	26"	18"	13"	9"	7"
5'-0"	44"	34"	22"	17"	11"	8"
6'-0"	52"	40"	26"	20"	13"	10"
8'-0"	72"	54"	36"	27"	17"	13"
10'-0"	90"	66"	45"	33"	22"	16"
12'-0"	104"	80"	52"	40"	26"	20"
15'-0"	132"	102"	68"	51"	34"	25"

Select Lens so Dimension "H" is Slightly Greater than "C"

Photo—Radio Corporation of America

RECOMMENDED TELEVISION SCANNING SYSTEM ARRANGEMENT FOR REMOTE OBSERVATION OF BOILER WATER LEVEL.

rangements require only a miniature camera and a compact control monitor, connected by ⅝-in. diameter camera cable. The system operates on 115 volt, 60 cycle power supply and is completely self-contained. Total power consumption is about 230-watts.

Components of the scanning unit include: a small, lightweight camera (about the size of a 16 mm movie camera); several television tubes; a special, adjustable swivel base; and a reflector type floodlight. The camera has a standard 16 mm motion picture camera lens with optional remote optical focus and offers standard (RMA) commercial scanning rates. One of the tubes, especially developed for industrial television, assures good, clear pictures with a minimum of 50 foot-candles of water gage front lighting.

The television monitor is a combination power supply, control panel, and receiver with 10-in. viewing screen—all housed in a metal case. It uses only 22 vacuum tubes and contains all of the controls required for operation including: picture brightness and contrast, camera beam intensity, and electronic and optical focus. Interlocking safety switches and complete shielding permit personnel to work in absolute safety. The monitor may be located up to 500 feet from the camera.

Auxiliary receivers are available to provide more than one picture or to extend the distance between the camera and the desired viewing location beyond 500 feet. Output signals from the control monitor are fed to these units, which can be standard TV receivers, by means of 75-ohm line, microwave transmission equipment.

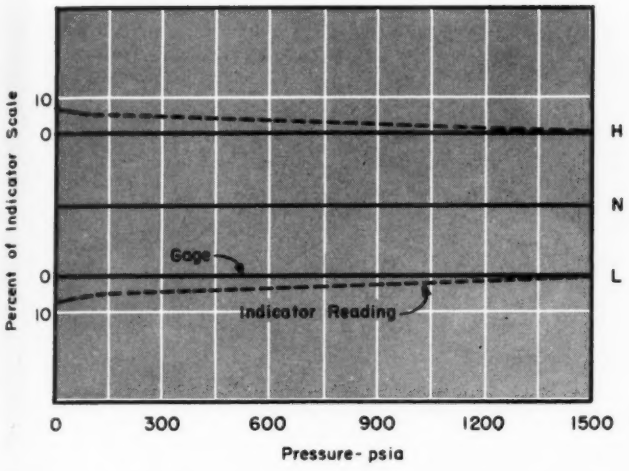
Remote Boiler Water Level Indicators

Regulations listed in the 1949 ASME Power Boiler Code state that two water gages are required on boilers operating at pressures over 400 psig. During the past one to two years, however, an investigation (Case 1155) was conducted to determine the suitability of remote instruments as substitutes for water gages. This study resulted in the ASME Boiler Code Committee reporting favorably as follows:

"It is the opinion of the Committee that two independent remote level indicators of the compensated manometric type may be used instead of one of the two required gage glasses for boiler drum water level indication in the case of power boilers with all drum safety valves set at or above 900 psi. When both remote indicators are in operation, the gage glass may be shut off but shall be maintained in serviceable condition.

"The remote indicators shall not depend for operation upon any external source of energy. Connections to the drum shall comply with present rules in paragraphs P-293 and P-320 for water columns and shall be completely independent of connections for other functions."

While this ruling is permissive rather than compulsory, it will be noted that where previously remote water level indicators were "supplementary"



CURVES OF TEMPERATURE COMPENSATED INDICATOR.

they now can be used as "primary" indicators of water level on high pressure boilers. This offers several advantages. With two remote indicators — preferably connected to opposite ends of the drum— replacing one of the drum gages, the operators have a true double check on the water level. These readings are at convenient eye height, eliminating the need for checking hard-to-see gages or for maintaining a system of mirrors.

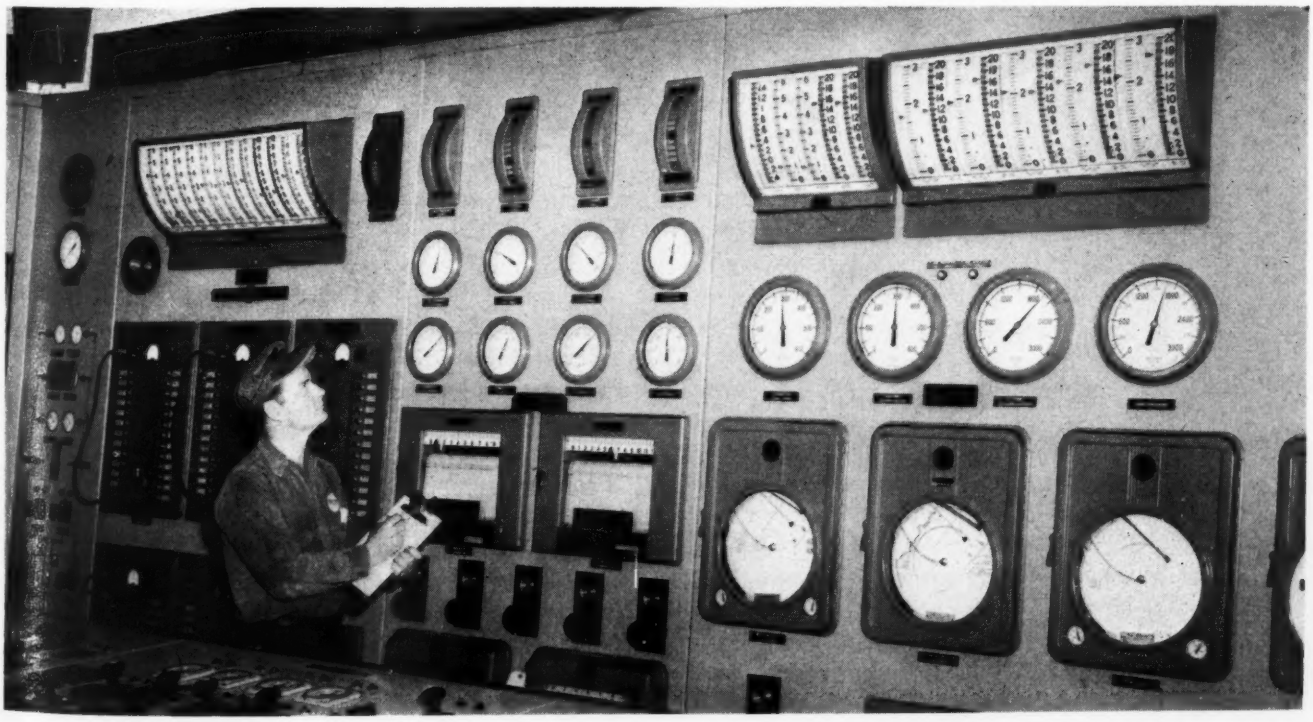
In an effort to develop a compensated instrument in accordance with the Code Case 1155 recommendation, some manufacturers have developed a temperature compensated instrument while others have developed a pressure compensated element.

The curves show typical percent errors for a temperature compensated unit calibrated for 1500 psig, based on gage densities. Note that at the normal level (middle of the scale) the instrument reads correctly for all pressures 0 to 1500 psig while for scale end points, even with a pressure as low as 100 psig, the percent error is only plus or minus 5 percent. Furthermore, the error is always on the safe side. In the low region, the instrument will read lower than the gage, and in the high region it will read higher than the gage.

There is an additional development under way to combine the best features of the temperature and pressure compensated elements to arrive at an instrument which will read accurately at all points of the scale and at all pressures zero to operating.

Future Developments

Trends toward steam generation at higher pressures and temperatures plus the increasing necessity for accurate water level indication at convenient locations will continue to influence gage development. The present flat glass insert gages were a radical change over the early round glass gages. In the future it is most likely that the design and materials of the gage will also be very different from those of the present. Mica usage, gasket materials that will effectively seal high pressure, gage glasses that will resist strain and chemical attack, and construction materials that will satisfy the service conditions all must be examined. Gage manufacturers will undoubtedly meet the challenging demands with equipment that will render maximum dependable service with minimum maintenance. ▲▲



TEMPERATURE COMPENSATED, MANOMETRIC TYPE, REMOTE LEVEL INDICATORS MOUNTED ON CENTRAL CONTROL PANEL.

Are You Controlling Employee Overtime?

Ce exclusive

ROBLEY D. STEVENS
Management Consultant

LOOK AROUND your organization. Can you account for your overtime expenditures? Have overtime costs gone up in the past several years? In fact, do you know precisely what your overtime bill is? What method do you use in figuring overtime pay?

A working knowledge of figuring overtime pay under the Federal Wage-Hour Law is a very practical matter, and one that requires constant attention. The United States Department of Labor checks architectural and engineering companies for compliance with the overtime provisions of the Wage-Hour Law. As a result of miscalculation and errors in overtime pay, many firms have had to recompute and pay out amounts of back overtime.

No particular method of payroll accounting is prescribed by law. The employees of a consulting organization can be paid on an hourly rate, piece rate, salary, or any other basis. But the statutory requirements regarding overtime must be met, whatever the basis of pay.

Section 7 of the Wage-Hour Law provides that an employer may not employ any employee qualified for overtime (see CONSULTING ENGINEER, September, 1954, page 43) for a work week longer than 40 hours "unless such employee receives compen-

sation for his employment in excess of the hours above specified at a rate not less than one and one-half times the regular rate at which he is employed."

If an employee in an engineering organization is employed solely on the basis of a single hourly rate, the hourly rate is his "regular rate." For his overtime work he should be paid, in addition to his straight-time hourly earnings, a sum determined by multiplying one-half the hourly rate by the number of hours worked in excess of 40.

Bonus Payments

Suppose, for example, that in addition to the earnings at the hourly rate, a bonus of 10¢ an hour is paid. The "regular" hourly rate of pay is then $1.10 an hour. The employee is then entitled to be paid a total wage of $53.90 for 46 hours (46 hours @ $1.10 plus 6 hours @ $0.55; or 40 hours @ $1.10 plus 6 hours @ $1.65).

If an employee in an engineering organization is paid a flat sum for a day's work or for doing a particular job without regard to the number of hours worked in the day or the job, and if he receives no other form of compensation for services, his regular rate is determined by totaling all the sums received at such day rates or job rates in the work week and dividing by the total hours actually worked. He would then be entitled to extra half-time pay at this rate for all hours worked in excess of 40 in the work week.

If an employee in an engineering firm is employed solely on a weekly salary basis, his regular hourly rate of pay on which time-and-a-half should be paid is computed by dividing the salary by the number of hours for which the salary is intended to compensate. For example, if an employee is hired at a salary of $40 and if it is understood that this salary is compensation for a regular work week of 35 hours, the employee's regular rate of pay is $40 divided by 35 hours, or $1.14 an hour. When he worked overtime, he would be entitled to receive $1.14 for each of the first 40 hours and $1.71 for each hour thereafter.

If an employee is hired at a salary of $40 for a 40-hour week, his regular rate is $1 an hour. If an employee receives a salary of $40 for a 44-hour week, his regular rate is 91 cents per hour, but also he would have to be paid at half rate for the extra four hours.

Work Week Equivalent

On the other hand, where the salary covers a period longer than a work week (such as a month) it should be reduced to its work week equivalent. A monthly salary is subject to translation to its equivalent weekly wage by multiplying by 12 (number of months) and dividing by 52 (number of weeks.) A semi-monthly salary is also translated into its equivalent weekly wage by multiplying by 24 and dividing by 52. Once, however, the weekly wage is established, the hourly rate of pay should be calculated as indicated above.

Fluctuating Average Rates

If an employee earns $46 per week, for example, with the understanding that the salary is to cover all hours worked, and if his hours of work fluctuate from week to week, his regular rate of pay will vary from week to week. Each week will have its own average hourly rate. Suppose that during the course of 4 weeks the employee successively works 40, 46, 50, and 41 hours. His regular rate of pay in each of these weeks is then approximately $1.15, $1.00, $0.92, and $1.12, respectively. Since the employee has already received straight-time compensation on a salary basis for all hours worked, only additional half-time pay is due. For the first week the employee would be entitled to be paid $46; for the second week he would get $49 ($46 plus 6 hours @ $0.50).

Where an engineering employee in a single work week is employed at two or more different types of work for which different basic hourly rates have been established, his regular rate for that week is the average of such rates; that is, his total earnings (except statutory exclusions) from all such rates are divided by the total number of hours worked.

Excluded Pay

There are certain payments that are excluded from the regular rate. This is provided for in Section 7(d) which states: "As used in this section, the regular rate at which an employee is employed shall be deemed to include all remuneration for employment paid to, or on behalf of, the employee, but shall not be deemed to include the following:

¶ Sums paid as gifts (such as those made at Christmas or on other special occasions) given as a reward for service—the amounts of which are not measured by or dependent on hours worked, production, or efficiency.

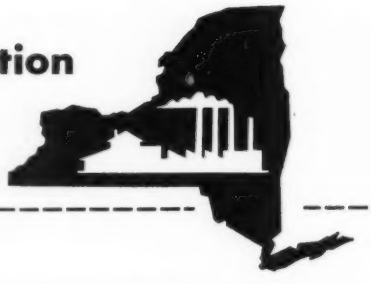
¶ Payments made when no work is performed due to vacation, holiday, illness, or failure of the employer to provide sufficient work, including traveling expenses.

¶ Sums paid in recognition of service performed if either (1) the fact that payment is made and the amount is determined at the sole discretion of the employer, and not pursuant to any prior contract, agreement, or promise causing the worker to expect such payment; or (2) payment made pursuant to a bona fide profit-sharing plan or trust plan meeting wage-hour rules.

¶ Contributions irrevocably made by an employer to a trustee, or to a third person pursuant to a bona fide plan providing for old-age, retirement, life, accident, health insurance, or similar benefits.

¶ Extra compensation provided by a premium rate

Plant-location news



What transportation facts do you need?

Recently, a container manufacturer using our Industrial Location Service to help select the right spot for his new plant, sent in this request: "*We've got to be located where we can supply* all *areas of our market within 36 hours at a cost that will let us compete for new business.*" As in many other businesses, the transportation costs and schedules involved could make or break his proposed operation. But ILS found the perfect location—fast.

Here are some of the reasons why. ILS is the *one* organization that can give complete, up-to-the-minute facts on transportation costs, schedules, and facilities. Whether your business calls for assembling heavy or bulky water-borne materials, or for the use of air transport to get there "fastest with the mostest," ILS can give you all the facts—secured *firsthand* from dozens of carriers.

We even maintain a Washington office to help in transportation problems. From this listening post we get current reports on tariffs, regulations, and schedules . . . and all of this information is included in our free transportation reports. To get one of these studies for your needs, all you do is contact ILS.

We fill in the picture, too

But this isn't the only type of transportation data ILS supplies. For one specialty-goods manufacturer we did all this: located sites with suitable warehouses for ceramic bodies, and within a short distance of LCL terminals. Even more important, we found him available sites with private railroad sidings.

For every suggested location, ILS also prepared rates for assembling materials and distributing finished goods to given points. Supplied comparative rates for air, rail, water, and highway, too.

By the way, the manufacturer received all these facts for a number of sites in *less than ten days*. Helped him pick just the right spot without delay.

Other free plant-site services

Transportation won't be your only concern when you're looking for a new plant location. But no matter what factors are involved, ILS can be of help. Reports are available on buildings and sites, markets, raw materials, labor, water and local laws and regulations—to mention just a few. These surveys are tailored to meet your requirements, and sent to you without cost or obligation in strictest confidence.

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Ronald B. Peterson

Director, Industrial Location Service

paid for certain hours worked by the employee on any day or work week because such hours are hours worked in excess of 8 in a day or 40 in a work week or in excess of the employee's normal working hours or regular working hours, as the case may happen to be.

¶ Extra compensation provided by a premium rate paid for work by the employee on Saturdays, Sundays, holidays, or regular days of rest, or on the sixth or seventh day of the work week, where such premium rate is not less than one and one-half times the rate established in good faith for like work performed in nonovertime hours on other normal working days.

¶ Extra compensation provided by a premium rate paid to the employee, in pursuance of an applicable employment contract or collective-bargaining agreement, for work outside of the hours established in good faith by the agreement as the basic, normal, or regular workday, where such premium rate is not less than one and one-half times the rate established in good faith by the agreement for like work performed during such workday or such work week.

Expect Inspections

Architectural and engineer organizations should stick to this anaylsis if they want to keep the overtime bill under control and within the law. The wage-hour inspector keeps an alert eye open for overtime pay practices that might tend to violate the rules. Wage-hour inspections can't be avoided, but they can be made less painful by sticking to the provisions of the law.

On the other hand, employees may be getting more overtime pay than is necessary because of unwitting mistakes in computation. Know what payments have to be made when your employees work more than 40 hours weekly. Overtime work is costly to every engineering firm, and yet some employers pay a larger amount than is necessary because they use the wrong method of figuring overtime pay. ▲▲

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WASTE TREATMENT INSTALLATION AT EACHUS DAIRIES. USING THE OXIDIZED SLUDGE PROCESS IN THE FIRST STAGE, THIS INSTALLATION HAS DEMONSTRATED A REMARKABLE EFFICIENCY.

Combining Efficiency With Economy In Industrial Waste Treatment

CP exclusive

CHARLES D. FRIDY
Fridy, Gauker, Truscott & Fridy, Inc.

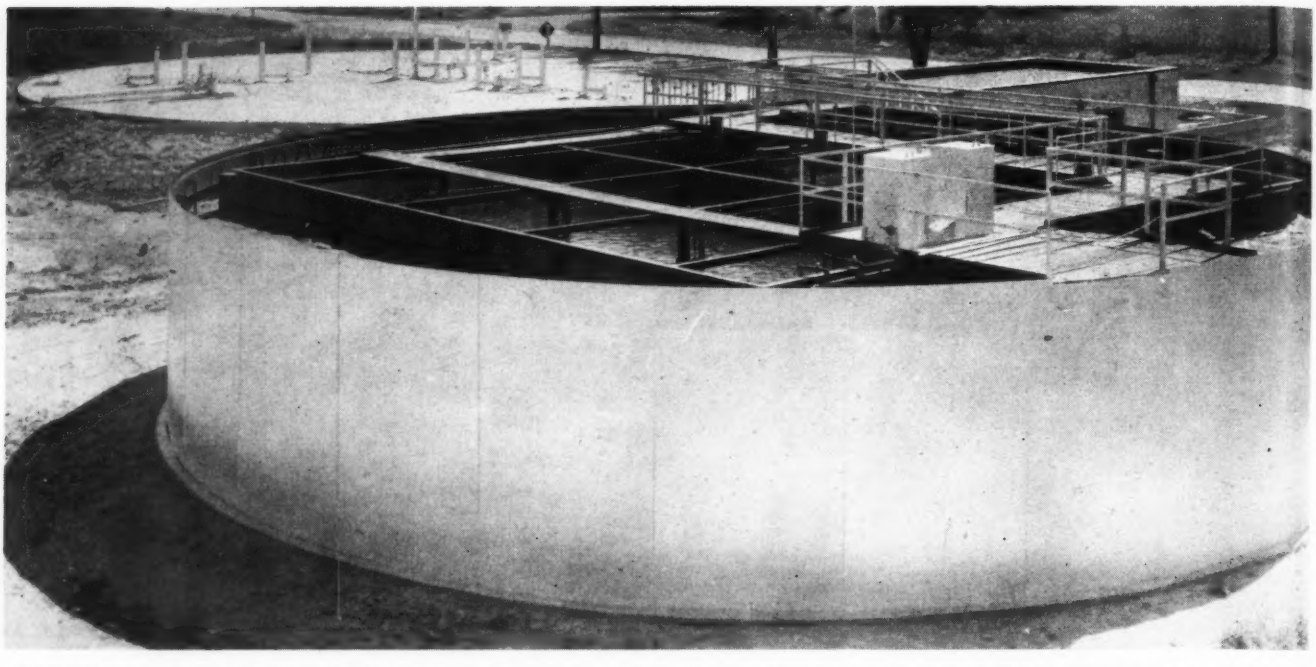
Charles Duhring Fridy, President of Fridy, Gauker, Truscott & Fridy, Inc., has had more than twenty years of widely diversified engineering experience. Particularly noteworthy is the successful operation of numerous industrial waste treatment plants which he designed. Mr. Fridy received his Masters degree in engineering from the University of Pennsylvania.

PROVIDING adequate facilities for the treatment of industrial wastes, now mandatory in many states, is a problem facing many American industries. With today's competitive markets, the cost of waste treatment often must be absorbed without increasing the cost of the product being manufactured. The cost, therefore, is of particular concern to the many small manufacturers and processors making up our Nation's industrial capacity.

From the viewpoint of many of the owners of small plants, any treatment facility, no matter how economical in initial and operational costs, becomes a capital burden or overhead cost. Their reaction is to provide only what is mandatory. Yet, this minimum must afford acceptable treatment results. A serious handicap is therefore imposed upon the engineers who design industrial waste treatment facilities because the usual factors of safety must be either eliminated or held to a minimum.

While many industries have complied with statutory requirements by constructing treatment plants of approved design, some find their facilities inadequately or improperly designed, while a relatively few have installations producing an effluent superior to statutory requirements by readily controlled, economical, and proven processes.

The design, construction, and operating results



THE WASTE TREATMENT PLANT AT MEAD, JOHNSON & CO. IS NOTEWORTHY FOR ITS HIGH DEGREE OF CLARIFICATION OF MILK WASTES. SHOWN ARE THE AERATOR-CLARIFIERS (FOREGROUND) AND THE REGENERATIVE DIGESTER.

of waste treatment facilities are directly dependent upon the assembly of reliable processing information, and the careful and qualified study of waste flow rates waste characteristics, and possible means for separating clean wastes from polluted wastes.

Each treatment plant must be individually designed to meet the conditions of the waste discharged from that particular industry. Precise but relatively simple treatment units utilizing job fabricated equipment have been designed and constructed, however, by applying data from comprehensive field investigations to developed mathematical formulas for patented processes.

Particularly difficult to treat are the wastes from food processing industries, such as milk plants and packing plants. However, patented processes installed in these plants and operated by average unskilled personnel, guided by simple laboratory tests, have been successfully demonstrated. The effluent has been found to be of a consistent clarity and stability often considered unobtainable by the utilization of stock equipment and processes.

Eachus Dairies

In a waste treatment plant built more than thirteen years ago for Eachus Dairies, West Chester, Pa., the "Oxidized Sludge Process", developed and patented by E. B. Mallory, was used in the first stage of treatment. Through the years this process has demonstrated a remarkable efficiency in consistently and effectively reducing the biochemical oxygen demand (BOD) and solids concentration.

The plant was designed for a normal load capacity of 100 lb of BOD per day and a maximum flow rate of 20,000 gpd. The effluent delivered to the stream was to have a five-day BOD not to exceed 50 ppm and suspended solids concentration below 25 ppm. In general, it consists of a waste collection and pumping unit, two hopper-bottom steel cylindrical tanks, a blower room and laboratory, and a separate unheated digestion tank.

The first stage, consisting of an aerator-clarifier unit, exhibited a BOD reduction during tests of better than 97 percent during 1941. The second stage, consisting of a chemical precipitation tank, further reduced the suspended solids which already were reduced to well below performance guarantees.

In 1951, after more than 10 years of continuous operation, the plant was given a three day test by the Pennsylvania Department of Health. This test showed a continuation of the original excellent performance, indicating an average reduction of 5-day BOD of 99.0 percent.

Mead, Johnson & Co.

In 1940, a complete milk waste treatment plant was designed and constructed for Mead, Johnson & Company, Zeeland, Mich. It consists of a pumping station with a grit chamber, pumps and compressors, an aerator-clarifier, a regenerative digester, and sludge drying beds. It reportedly was the largest milk waste treatment plant in the world, and it exhibited the highest degree of clarification and purification of milk plant wastes that had been accomplished to that time.

This plant demonstrated a system of control, using the Oxidized Sludge Process, that assured successful operation and an almost perfect effluent

under widely varying and greater loadings than had previously been considered possible. It introduced an innovation in anaerobic digestion and demonstrated the possibility of almost complete treatment of highly concentrated wastes by the Regenerative Digestion Process alone. To date, more than ten years later, the digestion of solids reportedly has been so complete that no digested sludge has been removed from the digester and the supernatant returned to the general waste sump from the digester has not been detrimental to the plant operation.

Rock Gate Farm Dairy

Another complete milk waste treatment plant using the Oxidized Sludge and Regenerative Digestion Processes was later constructed to serve the Rock Gate Farm Dairy at Bedford Hills, N. Y. It is enclosed in a brick building located within sixty feet of an open dining terrace operated by the Dairy, and it is across the street from the Town Hall.

Proof of the adequacy and reliability of this treatment plant is evident in that its effluent is discharged into a stream flowing into a nearby New York City potable water reservoir. The operation of this plant therefore comes under the surveillance of both the New York State Department of Health and the City Water Bureau. Reports over a period of time indicate the final effluent turbidity ranges from a minimum of 2.0 ppm to a maximum of 6.4 ppm with an average pH of 7.8.

Recent Installations

Following the pattern of their predecessors, two waste treatment plants recently constructed in Eastern Pennsylvania employ the Oxidized Sludge and Regenerative Digestion Processes. These two plants, while of comparable flow capacity, are designed to treat extremely different types of wastes.

The first plant, placed in operation in 1950, treats highly concentrated slaughter and toilet wastes from the abattoir of A. D. Pierce & Son, Kennett Square. The second plant, placed in operation the following year at Glen Roy, treats highly concentrated, caustic and general floor wastes from the dairy receiving plant of Turner & Wescott, Inc., and domestic wastes from several adjacent residences.

A. D. Pierce & Son

The abattoir of A. D. Pierce & Son, located outside the limits of the town's sewerage system, was faced with the alternative of either providing adequate and approved waste treatment facilities or of being forced by the Sanitary Water Board of the Commonwealth to discontinue the discharge of its wastes to the adjacent watercourse.

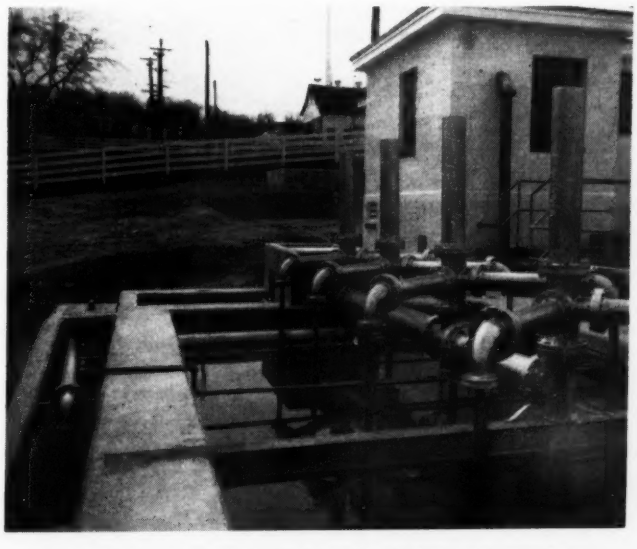
The facilities for treating the abattoir wastes include fine screening, pre-aeration, primary sedimentation, waste and sludge pumping, Oxidized-Sludge aeration and clarification, sludge concentration, and Regenerative Digestion. Since the treatment tanks were mostly above ground, wood stave tank construction offered a high degree of structural and functional flexibility. In addition, heat losses for the 3-inch thick wood staves of the heated digestion tank compared favorably with heat losses normally encountered with 12-inch concrete walls.

Primary Treatment—The primary department, consisting of a screen chamber, pre-aerator, and primary sedimentation tank, is constructed of reinforced concrete below grade, and is flanked by a basement pump room. A frame superstructure houses the blower room, control equipment, and a small laboratory.

The combined raw general and toilet wastes entering the plant flow through a trough type perforated screen for manual removal of the grosser solids. Screenings are removed with slaughter offal daily. The screened wastes flow into a rectangular, sloping-bottom pre-aerator, equipped with a 40-jet air diffuser unit for chilling and grease flotation. A bottom draw-off transfer pipe, with air-lift assistance, discharges into a rectangular, sloping-bottom, primary sedimentation tank providing a two hour detention period in the supernatant zone.

Two horizontal raw waste pumps take suction from either or both the supernatant and sludge zones of the primary tank through a manifold of valved, 2-inch piping. These pumps automatically transfer primary settled supernatant to the secondary units during the day and sludge to the digester at night. The controls for the pumps are actuated by liquid level electrodes and time control devices.

Secondary Treatment—The secondary department, consisting of an aerator-clarifier and mixed liquor concentration tanks, is constructed of wood-stave



CLARIFIER AND CONTROL BUILDING AT TURNER & WESCOTT. RECYCLING CASCADE IS AT THE LEFT.

WOOD STAVE DIGESTER AND AERATOR-CLARIFIER TANKS WERE USED AT A. D. PIERCE & SON.

tanks supported by concrete block footings. The aerator-clarifier is an ellipsoidal-bottom, horizontal, wood-stave tank having a central aeration compartment with five 40-jet air diffuser units, and flanked on each side by clarification compartments. It has a nominal BOD capacity of 100 lbs per day, and an average flow rate of 20 gpm.

Mixed liquor flows under curtain baffles from the aeration compartment to the lower portion of the two clarification compartments. The separation of the suspended solids and clear liquor forms a sludge blanket through which the upward flow provides the greatly-to-be-desired "upward filtration," thereby increasing the clarification. The effluent then flows over continuous longitudinal weirs from the clarification compartments into launders which collect it and discharge it to the receiving stream.

Sludge settling on the bottom of the clarification compartments drifts by gravity down a sloping tank bottom to the central aeration compartment, aided by suction resulting from mixed liquor moving from the down-draft channel into the lower section of the aerator. Excess sludge in pre-determined quantities, as mixed liquor, is removed daily by gravity from the end of the aerator and is stored in a round, hopper-bottom, wood-stave concentration tank where it is allowed to settle for several hours.

At night, under automatic control, the supernatant from the concentration tank is returned to the primary tank and is transferred, with all primary supernatant remaining from the day's operation, to the aerator. Primary sludge is then transferred to the concentration tank, to remain in a quiescent condition for several hours. Supernatant therefrom is returned automatically to the primary tank and the combined sludges are pumped to the regenerative digester.

Digestion—The regenerative digester consists of two concentric baffled tanks providing two temperature zones. The inner high temperature zone has two compartments, while the outer low temperature zone has four compartments. Sludge to be digested is delivered with highly concentrated blood waste to the high temperature zone. The sludge or supernatant, or both, then flows through suitably disposed ports into the respective high and then low temperature zones.

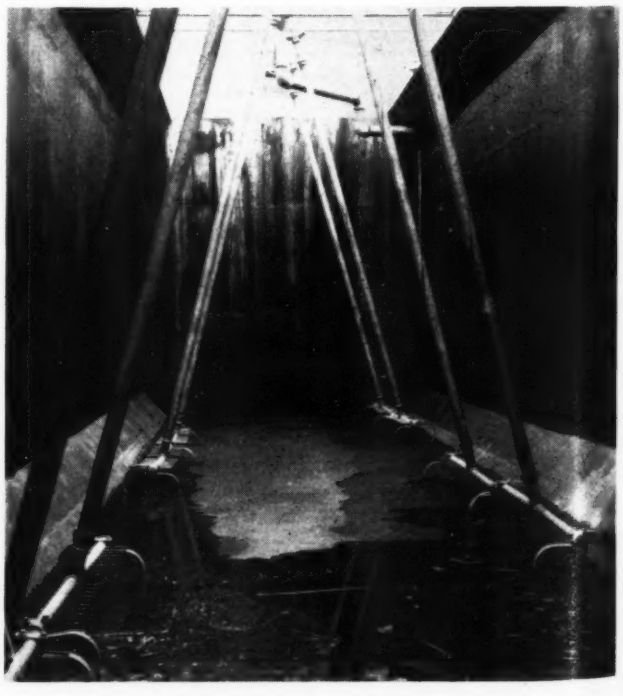
The supernatant flows by gravity through a gas-trapped outlet to the influent end of the aerator or, when desired, to the pre-aerator. Steam, introduced under automatic temperature controls to two vertical steel heating drums in the high temperature compartments, condenses to hot water which heats these compartments to the desired temperature of 104 to 108 F. Air-lift transfer pumps return sludge from any low temperature compartment to the high temperature zone for regeneration.

The digested sludge is removed periodically to a tank truck by an air-lift pump and is used as a liquid fertilizer.

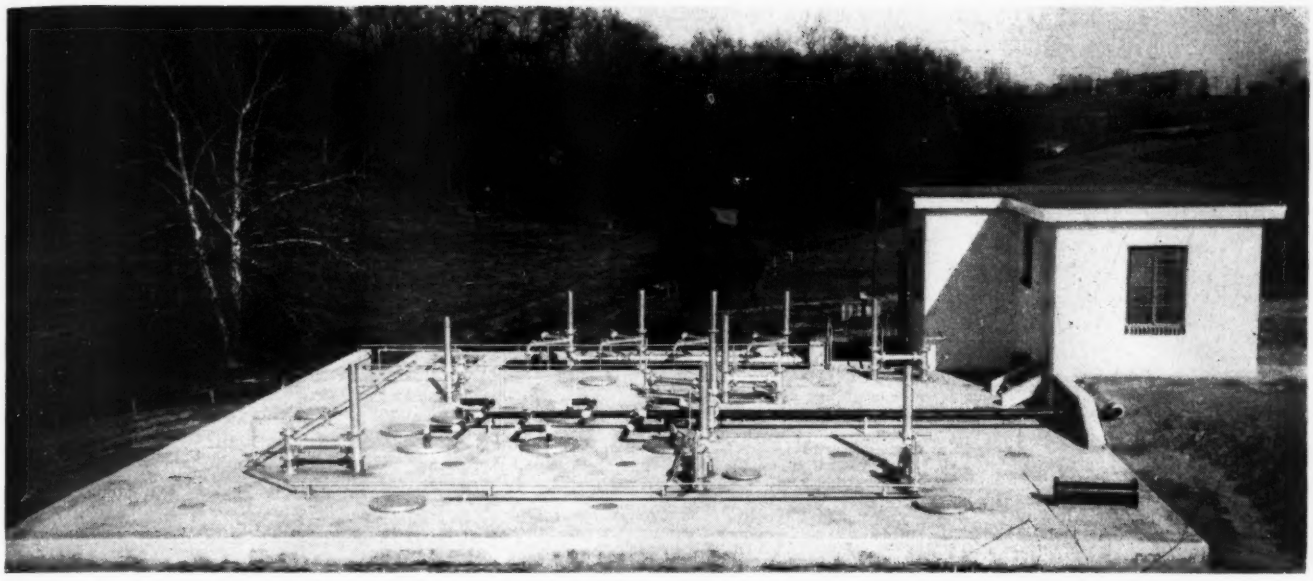
Tests made by the State Department of Health, after more than a year's operation, exhibited a reduction of suspended solids and of BOD in excess of 90 percent, or well within the statutory requirements. To date, the regenerative digester has so thoroughly reduced the treatment plant sludge and highly concentrated blood solids that excess solids need be removed only once per season.

Turner & Wescott, Inc.

Turner & Wescott, Inc., with a rural location along a watercourse, was restrained by downstream riparian property owners from discharging into



VIEW OF JET DIFFUSERS IN ONE SECTION OF THE AERATION TANK INSTALLED AT TURNER & WESCOTT.



REGENERATIVE DIGESTION TANK AND CONTROL BUILDING AT TURNER & WESCOTT. THE DIGESTER CONSISTS OF TWO CONCENTRIC SQUARE TANKS WITH DIVIDING WALLS ARRANGED TO PROVIDE THREE TEMPERATURE ZONES.

the stream untreated milk receiving and processing wastes from the creamery, and domestic wastes from the several nearby residences. The new treatment facilities are downgrade from the dairy, thus permitting gravity flow of general and domestic wastes, caustic wastes, and highly concentrated wastes through separate sewers.

This treatment plant is divided into two distinct units. The primary department provides facilities for fine screening, grit removal, caustic waste neutralization and chemical storage, and excess general waste leveling, while the secondary department provides for aeration, clarification and supersaturation of the effluent, and Regenerative Digestion. A control building houses laboratory facilities and the blower machinery.

Primary Department—Tracing the flow through the plant, the general wastes enter the primary department, passing through a basket-type fine screen that removes the grosser solids, and into a hopper-bottom concrete grit chamber equipped with an air-lift pump to scour and continuously lift the grit into a waste container. The wastes and entrained organic matter overflow the top and return to the basket screen to aid in breaking up solids.

Screened waste flows over a 90-degree weir, at a controlled rate of 20 gpm maximum, to the aeration tank in the secondary department. Any excess flow automatically spills over a triple 90-degree weir to a 5000 gallon hopper-bottom, concrete, aerated, leveling tank, equipped with three 40-jet aeration units operated by liquid level controls. During the early evening hours, the aerated leveling tank is drained automatically through the general drain to the aeration tank in the secondary department.

Caustic and acid wastes from cleaning operations are collected separately and discharged into a small hopper-bottom, concrete, aerated, neutralization tank having two 40-jet aeration units operated by liquid level controls. When the tank becomes sufficiently full, its contents are tested for pH and alum is added until the pH is approximately 7.0. It is then automatically drained to the aeration tank during the early evening hours.

Secondary Department—In the secondary department, the concrete aerator tank consists of three rectangular compartments equipped with eighteen 40-jet diffuser units staggered in the first two compartments to provide "Shear-Core Aeration." Passing consecutively through the three compartments, the aerated sewage enters the baffled end of a rectangular, eight-hoppered, concrete clarifier, flows to the effluent end, and then through a baffled launder to a stair type recycling cascade for super-saturating prior to discharge to the receiving stream.

The secondary cycle full load capacity (5-day BOD) is 135 lbs per day, and the average daily flow rate is 27 gpm.

Sludge from the eight clarifier hoppers is continuously raised by air-lift pumps to a collection header, and is discharged over a 90-degree weir into the first pass of the aerator. A staff gage indicates the rate of return sludge discharge.

A pre-determined quantity of excess sludge is withdrawn nightly from the first hopper of the clarifier and, under automatic air-control, lifted by a separate air-lift pump to the high temperature zone of the digester. Also, all highly concentrated wastes such as cheese whey, whey wash waters, can washing pre-drip, and the first flush of the pan rinse are collected separately, and discharged directly

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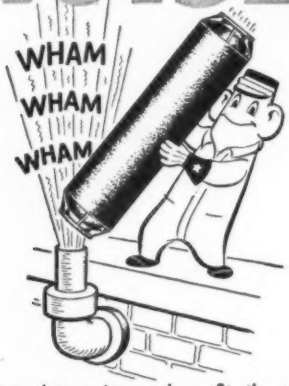

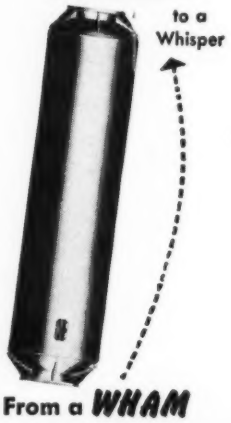

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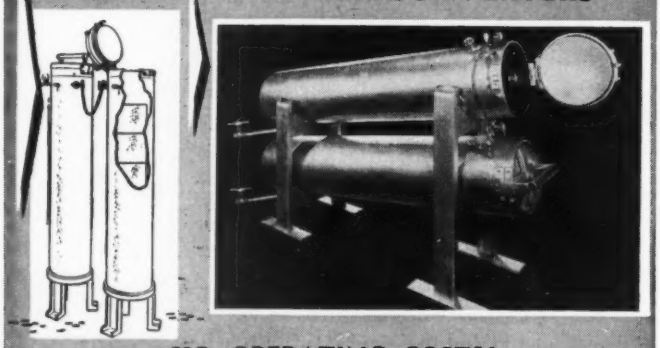

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into the high temperature zone of the digester.

Sludge Digestion—The regenerative digestion tank, constructed of concrete with concrete-block partitions, consists of two concentric square tanks with sub-dividing walls arranged to provide three temperature zones. The inner zone is divided into two high temperature compartments. The surrounding adjacent zone consists of four medium temperature compartments and an adjoining outer area of two low temperature compartments.

Steam introduced under automatic control to six steel heating tanks in the high temperature zones condenses to hot water which heats the digester. A recorder-controller maintains the high temperature zone at 102 to 106 F.

Excess sludge and highly concentrated wastes flow through the high, medium, and low temperature compartments respectively. Air-lift pumps are provided for returning sludge to be regenerated from either of the low temperature compartments to the medium temperature compartments, or from any of the medium temperature compartments to the high temperature compartments. Supernatant liquor from the last low temperature compartment is returned through a gas trap to the influent end of the second pass of the aerator.

The reduction capacity of the regenerative digestion tank is 650 pounds of volatile solids per day. The tank provides a total theoretical detention period of 17 days at average loading.

This plant has displayed a consistent record of excellent performance by producing an effluent with a turbidity range of 6 to 9 ppm and an average relative stability of 99 percent. The digester has so fully reduced the solids component of the highly concentrated and excess secondary sludge wastes that it has not been necessary to remove any solids since the plant started in operation. In spite of a fire at the creamery in 1953, which caused the loss of steam for heating the digester, no serious upsets have been reported.

Conclusion

The waste treatment plants described in this article demonstrate that, with a careful determination of flow and waste loadings properly applied to developed mathematical formulas for patented processes, relatively simple waste treatment facilities can be designed to produce an effluent which more than meets the necessary requirements.

These installations are producing effluent consistently within the statutory requirements, Yet, construction costs were held at a practical minimum and maintenance costs have been relatively low. Only a small amount of power driven equipment has been used, and the control of operations has been planned so that it may be accomplished as a routine procedure. ▲▲

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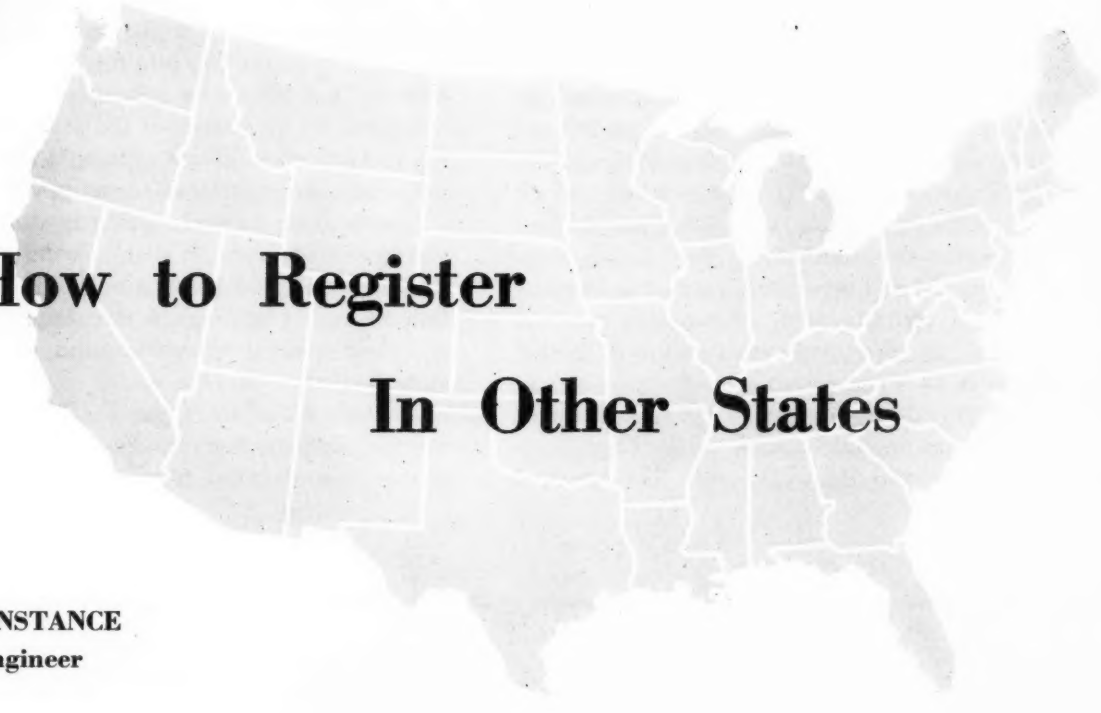


How to Register In Other States

JOHN D. CONSTANCE
Consulting Engineer

CONSULTING ENGINEERS do not accept state boundaries as a limitation upon their practice. The registration of engineers, however, is a function of the individual states and a license to practice professional engineering cannot be transferred from one state to another. Thus, the consultant is frequently confronted with the necessity of obtaining registration when he accepts an assignment in a state in which he has not previously registered.

Many state boards permit a registrant of another state to practice temporarily without obtaining permanent registration if he has only an occasional assignment. Each state has set a limit for temporary practice. In Ohio the limit is for an aggregate of sixty days, while in New York it is thirty days.

Licensure by Endorsement

To promote and facilitate the flow of engineering talent across state lines, most states provide for licensure by endorsement for those engineers previously registered in another state. Although the requirements differ with each state, written and oral examinations are waived by most boards if the applicant has passed a reasonably equivalent written examination in another, or if the applicant is a registered engineer with an established practice of long standing and if he has a recognized standing in the engineering profession. Most of the states also require that the applicant be registered in his home state. The applicant must, of course, also meet such statutory requirements as age, citizenship, and experience.

According to the National Council of State Boards of Engineering Examiners, forty-six states give maximum possible credit to examinations given by other boards. Two states require an oral examination regardless of written examinations previously taken in other states, and one board recognizes examinations given by only those boards with which it has reciprocal agreements.

National Council

The National Council of State Boards of Engineering Examiners (NCSBEE) acts as an advisory and coordinating agency. It was established primarily to assist State Boards of Registration for Professional Engineers in a cooperative effort for more efficient and uniform registration laws. The Council promotes procedure for interstate registration (registration by endorsement), and provides a medium for discussing and developing the solution to this difficult problem.

The Council maintains offices at Columbia, S. C. Its Executive Secretary is T. Keith Legare'.

One of the functions of the Council is the National Bureau of Engineering Registration, established to minimize the effort, embarrassment, and expense required of registered engineers when obtaining licensure in another state. The Bureau is a fact-finding and certifying agency serving as a reliable source of information, and it acts as a clearing house for the professional records of engineers.

Certificate of Qualification

In practice, the Bureau reviews an engineer's record of experience and conducts a study of his registration with his own state board. If the results of these studies meet with the Bureau's approval,

it issues a Certificate of Qualification.

The Certificate does not serve as a national license, and State Boards of Registration do not permit its use in lieu of their own state licenses. Registration of engineers is legally established as a function of the police powers of the individual states, and it is one of the state rights still cherished.

The Certificate serves only as a verified record of the engineer's experience, and is not considered as sole evidence of qualification for registration. Each case is considered separately on its own merits. The Certificate consists of a photostatic copy of the engineer's record with the seal of the NCSBEE embossed on it. It is not suitable for framing.

When applying for registration by endorsement, the candidate may include a copy of the Certificate (obtainable from the Bureau) with the standard state application form. All state boards require that a candidate bring his experience record up to date when submitting his application. This may be done either by bringing the original Bureau record up-to-date so that it can be submitted with the application form, or by filling out the state application form in its entirety and submitting this up-to-date information on experience directly to the state board.

Certification in engineering is still comparatively young. Unlike the Medical Professional Certification, the National Bureau of Engineering Registration has not yet reached the stage of development where it can give examination acceptable to all state boards.

Another function of the NCSBEE is its Committee on Registration by Endorsement. This Committee has devoted many years of effort to the

CONDITIONS FOR REGISTRATION BY

ALABAMA—Graduation from approved school plus 4 yrs satisfactory experience.

ALASKA—Each case considered individually. Prior registration under equivalent requirements. Proof of residence required. For non-residents: temporary permit not to exceed 1 yr and limited to 1 engagement.

ARIZONA—Prior registration by: written examination, long established practice, or graduation plus 4 yrs satisfactory experience.

ARKANSAS—Weight given to prior registration by written examination. Training and experience satisfying requirements. Independent investigation made of qualified non-residents. No reciprocity agreements with other states.

CALIFORNIA—Oral examination required for applicants with valid registration. Written examination may be required.

COLORADO—Graduation from approved school plus 3 yrs satisfactory experience. Without educational credits: 7 yrs satisfactory experience. Prior registration under equivalent requirements. No written examination except doubtful cases.

CONNECTICUT—Graduation from approved school plus 4 yrs satisfactory experience. Prior registration by equivalent examination plus 8 yrs satisfactory experience.

DELAWARE—Education, training, and experience satisfying requirements. Prior registration and National Bureau certification immaterial.

FLORIDA—Training and experience satisfying requirements plus prior registration by equivalent written examination. Prior registration plus evidence of long established responsible practice (over 15 yrs).

GEORGIA—Prior registration under equivalent requirements. Oral examination in doubtful cases.

HAWAII—Prior registration by equivalent written examination. Established standing with over 12 yrs experience. National Bureau certification accepted.

IDAHO—Prior registration by written examination if reciprocal agreement with other state. May deny reciprocal registration if prior registration not by written examination.

ILLINOIS—Registration prior to 1946, by graduation from approved school plus 4 yrs experience. Graduation from approved school, 15 yrs experience, and recognized distinction.

INDIANA—Prior registration by: written examination, on qualification prior to 1950, or under "grandfather clause" prior to 1923.

IOWA—Prior registration by written examination. Personal interview or other evidence if prior registration not by written examination.

KANSAS—Training and experience satisfying requirements.

KENTUCKY—Prior registration by: graduation and 4 yrs experience, or 8 yrs experience and 2-day written examination.

LOUISIANA—Graduation from approved school. Other requirements undergoing change.

MAINE—Graduation from accredited curriculum plus 4 yrs qualifying experience. Equivalent written examination in other state in lieu of Maine examination. High professional standing plus oral examination. National Bureau certification usually accepted.

MARYLAND—Graduation from approved school plus 4 yrs experience. Long established practice (over 12 yrs).

MASSACHUSETTS—Satisfaction of minimum statutory requirements (Model Law). National Bureau certification accepted.

MICHIGAN—Prior registration or National Bureau certification under equivalent requirements plus 12 yrs satisfactory experience. Registration by equivalent written examination.

MINNESOTA—Prior registration by equivalent requirements if state extends similar privileges to Minnesota. Graduation from approved school prior to 1945 plus 4 yrs satisfactory experience. Oral examination waived if: National Bureau certification or if reciprocal agreement between states.

MISSISSIPPI—No statement furnished.

MISSOURI—Equivalent oral or written examination plus 8 yrs satisfactory experience. Graduation from fully accredited school plus 4 yrs satisfactory experience. Reciprocal agreements not required for registration by endorsement, but are required for reciprocal registration.

MONTANA—Prior registration: before 1948 on graduation plus 4 yrs experience, or 12 yrs lawful practice including responsible charge of important work. National Bureau certification accepted.

problem of engineers requiring registration in more than one state. Registration by endorsement is an ever-changing problem, but fortunately it is moving in the right direction.

Requirements for Registration

In its studies of interstate registration problems, the Committee has compiled a list of each state's requirements for registration by endorsement. A condensation of this list is reproduced below. Although the list does outline the general requirements of each board, it should be noted that all boards reserve the right to make independent decisions as to the acceptance of any information on applications, since the applicants' qualifications must conform to the requirements of their laws.

The list compiled by the Committee reflects considerable progress toward greater uniformity of procedure among the individual State Boards of Registration. Many of the states now recognize examinations given by other boards. There is a definite indication of reciprocal agreements between states, and many boards are now using the National Bureau certification. Although a number of boards do not so state in writing, acceptance of the Bureau certification is more widespread than indicated by this list.

Questions concerning reciprocal agreements between boards, lists of accredited schools of engineering, and other problems pertinent to the applicant's situation must be referred to the Secretary of the state board concerned with the applicant's problem, since it alone reserves the right to make changes in the requirements. ▲▲

ENDORSEMENT WITHOUT WRITTEN EXAMINATION

NEBRASKA—Prior registration by written examination of reasonably high standards. Outstanding experience, including 5 yrs responsible charge of engineering work.

NEVADA—Oral examination required.

NEW HAMPSHIRE—Satisfaction of statutory requirements. Eminent standing in the profession.

NEW JERSEY—Prior registration by equivalent written examination. Fifteen years lawful practice. National Bureau certification plus satisfying statutory requirements.

NEW MEXICO—Graduation from accredited school plus 4 yrs satisfactory experience.

NEW YORK—Prior registration by: equivalent written examination, or evidence of recognized standing and long established practice (over 15 yrs).

NORTH CAROLINA—Prior registration by: written examination, long established practice, or graduation plus 4 yrs. progressive engineering experience. National Bureau certification accepted.

NORTH DAKOTA—Education, 10 yrs experience, eminence, and prior registration by personal interview or oral examination.

OHIO—Prior registration by written examination. Long established experience if registered prior to 1938. Registration prior to 1946 by graduation plus 4 yrs experience. Registration under "grandfather clause" prior to 1935.

OKLAHOMA—By reciprocity agreement with other states. National Bureau certification accepted.

OREGON—Prior registration by: equivalent written examination, or 6 yrs engineering experience (including 2 yrs in responsible charge) prior to enactment of registration in applicant's home state.

PENNSYLVANIA—Prior registration by written examination if other state accepts Pennsylvania examinations.

PUERTO RICO—By reciprocal agreement. Investigation of original state registration.

RHODE ISLAND—Graduation from approved school plus 4 yrs satisfactory experience. Twelve years lawful practice of satisfactory character provided applicant not less than 35 yrs of age.

SOUTH CAROLINA—Prior registration by: written examination, long established practice, graduation plus 4 yrs experience, or "grandfather clause" if education and experience are acceptable. National Bureau certification accepted.

SOUTH DAKOTA—Prior registration by: written examination if other state accepts S. D. examinations, or long established practice if states have reciprocal agreement.

TENNESSEE—Graduation form approved school plus 4 yrs experience. Prior registration by: written examination, or long established practice. National Bureau certification accepted.

TEXAS—Graduation from engineers Council for Professional Development accredited course plus 4 yrs satisfactory experience. Prior registration by written examination plus 8 yrs satisfactory experience. Twelve years of experience including 5 yrs in responsible charge, provided registration in other state prior to 1942 and applicant over 34 yrs of age when registered.

UTAH—Prior registration by: graduation plus 4 yrs qualifying experience, or written examination plus 8 yrs experience.

VERMONT—Graduation from 4-yr course plus 3 yrs experience. Prior registration.

VIRGINIA—Prior registration by equivalent requirements if reciprocal privileges are extended by other state. If prior registration not by written examination, 10 yrs of responsible practice. Personal interview may be required.

WASHINGTON—Satisfaction of qualification requirements.

WEST VIRGINIA—Graduation from approved school. Prior registration by equivalent written examination. Long established professional experience and outstanding accomplishments, plus oral examination.

WISCONSIN—Graduation from approved curriculum plus 4 yrs experience. If over 35 yrs of age: 12 yrs engineering experience. National Bureau certification may be accepted.

WYOMING—Prior registration by: written examination plus experience satisfying requirements, Eminence Clause, or without examination if applicant unanimously approved by Wyoming Board.

DRAFTSMEN FREQUENTLY SPEND SIX TO SEVEN HOURS OF THE DAY CROUCHED OVER THE DRAWING BOARD. WELL-DESIGNED DRAFTING FURNITURE GOES A LONG WAY TOWARD ELIMINATING THE USUAL AFTERNOON LET-DOWN.

CE exclusive

What the Draftsman Wants in

Drafting Room Furniture

WHEN SELECTING drafting room furniture, the draftsman's comfort warrants the same consideration as good lighting or ventilation. Comfortable working conditions not only result in a better employee morale, but also tend to increase employee efficiency by minimizing fatigue. Well constructed drafting furniture also eliminates the distractions that inevitably occur as the result of a wobbly stool or a creaky table.

Factors Influencing Selection

To say that one type of chair or one type of table is suitable for all drafting rooms and all draftsmen would be erroneous. Such factors as the available floor area, the type of drawings being produced, and the individual nature of each employee's work enter into the selection of drafting tables. And the type of drafting chair — high or low, with or without casters — is determined by the type of table used and the draftsman's individual preferences.

Most draftsmen do agree on certain basic fundamentals that should be incorporated in the design of drafting furniture. Most prefer a chair with a back rest. All agree that the legs should be widespread so as to provide stability. And there should be four legs — not three as used on many of the wooden stools of the past.

Where large drawings are involved, high tables and chairs are normally used so that the draftsman can easily shift between a standing and a sitting position. Since the draftsman's feet do not reach the floor when he is seated on a high chair, a ring around the outside of the legs or some other type of footrest is important.

A second place for the feet also is desirable so that the draftsman can occasionally change his sitting position. If the table itself does not incorporate a footrail, a wooden box about 4 to 8 inches high is handy. Besides serving as a footrest, it can be used as a step for reaching the upper portions of large drawings.

Seat Design

Perhaps the greatest divergence of opinion among draftsmen is on the question of what constitutes a comfortable seat design. Any of a number of shapes

Do/More Chair Co.

CORRECT POSTURE AND THE "DRAFTSMAN'S SLUMP" DEMONSTRATED BY MEN AT WHITIN MACHINE WORKS.

are favored, including rectangular and round designs. Some draftsmen prefer a cushion, but others like a hard seat — wood rather than metal.

If chairs with hard seats are purchased, cushions can be offered to those draftsmen who want them. Cushions designed to fit the contour of the seat or a type having drawstrings are desirable, since loose cushions invariably slide onto the floor when the draftsman stands up. One very practical cushion is the type molded of sponge rubber and covered with felt. These cushions can be purchased to fit the contour of the chair seat.

There are many good upholstered drafting chairs. These provide a much deeper cushion than would be practical with slip-over cushions. Special attention to the material used for upholstering is advisable, however, since drafting chairs are subject to heavy wear. Separate cushions have an important advantage in that they can be inexpensively replaced when they become worn.

Back Rest

A back rest is preferred by almost all draftsmen. After several hours of drafting in the usual slumped position, the leg and back muscles become strained and a general feeling of weariness is experienced. A back rest, designed to give proper support to the small of the back, allows the draftsman to occasionally lean back for needed relief.

Adjustments for the back rest are advisable since support in the wrong place is little better than none at all. Any one or combination of three basic adjustments are common: adjustment for the angle of the back rest, adjustment in a horizontal plane, and adjustment in a vertical plane. Some backs are flexibly mounted, while others are rigid. Preference for flexible back rests seems to be an individual matter. If the back is too flexible, however, it can be objectionable. Since the chair is relatively high, the feeling of falling backwards is a rather unnerving experience.

Swivel-mounted seats for drafting chairs are considered best. Arm rests are available on some types of chairs, particularly desk-height chairs, but the arm rest is conceded to be unnecessary. Casters, normally used with desk-height chairs, also are used with some of the high type chairs. They are particularly convenient when long tables and large drawings are involved.

Adjustments

The means provided for adjusting the height of the drafting chair warrants special attention. If adjustments can be made easily they will be used to advantage, but if they require much effort, they are not likely to be used at all. This also applies to the adjusting mechanism provided for changing the slope of the drawing board.

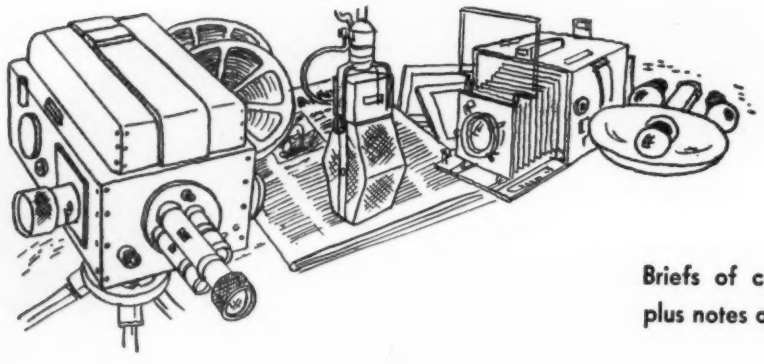
A table design that has gained favor in recent years because of its space-saving aspects is the type having an adjustable drawing board mounted on the back side of a horizontal desk. Used in a row, these tables provide each man with an individual desk, complete with standard desk drawers. When working at the board, the man's desk is behind him. Desk-height chairs with a swivel are normally used with this type of drafting table.

Faced with the alternative of either conserving space in its engineering department or acquiring additional floor space, Whitin Machine Works, Whitinsville, Mass., recently replaced all of its drafting tables with the combination drafting board and desk. The result was a space saving of 40 percent.

Posture Chairs

Along with the new tables, Whitin installed chairs specifically designed to promote good posture. The chair manufacturer supplied an adjusting service with the posture chairs, and the importance of maintaining a good sitting position was explained to each draftsman. The functions of the chair were explained and suggestions were made on ways of readjusting habits so as to form practices conducive to good posture.

According to S. H. Helland, Chief Products Engineer at Whitin, the posture chairs have eliminated the wiggling and squirming of draftsmen trying to find a new sitting position. Also, the draftsmen now sit erect in front of their drafting boards "instead of crouching over their boards like human pretzels."



NEWS

Briefs of current interest to the consulting profession plus notes on new equipment in the field of engineering

Deep-Sea Diver Inspects Desert Dam

THIS IS WHERE HE WENT DOWN (OFF PIER AT RIGHT IN PHOTO).

AND THIS IS HOW HE LOOKED WHEN HE CAME UP 147 MIN LATER.

Hired by the Salt River Power District to make preliminary inspections of penstock screens at the base of Horse Mesa Dam, near Phoenix, Ariz., E. R. Cross, master diver, spent three days prowling the floor of Apache Lake which is impounded by the dam serving the Salt River Valley.

The object of the inspection was to determine the need for repairs of the penstock screens and other allied equipment. Based on the diver's findings, Power District officials decided to lower Apache Lake 50 ft—equivalent to 113,000 acre ft. A bulkhead will be placed around the penstock area enabling the workmen to recondition the penstock and surrounding area, to paint the interiors and exteriors, and to repair the tunnel gates. This method will cost approximately $80,000; nearly $50,000 less than the method of totally draining the lake.

A veteran of 20 years of deep-sea diving, Cross contends that this Horse Mesa Dam assignment has been one of his toughest. The entire inspection was carried out by feel, 250 ft below the surface in complete darkness.

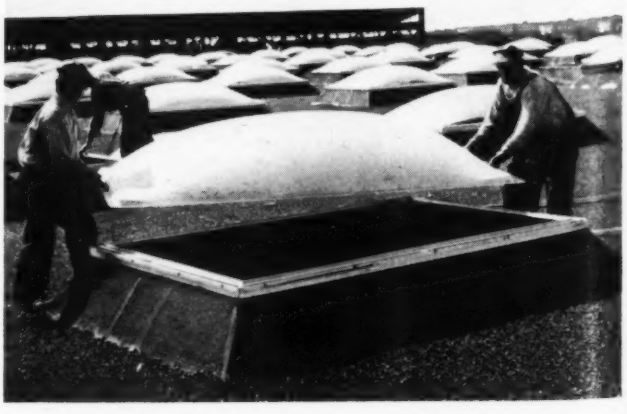
This is the fourth such inspection carried out by Cross for the Salt River Power District, the last being an inspection of Roosevelt Dam.

Planning at Design Level Assures Well Lighted Buildings

Natural lighting is still preferred by many architects and engineers—if it is planned for in the design of the building in such a way as to provide maximum light transmission.

In the windowless 680,000 sq ft operations building of the U. S. Signal Corps Depot at Tobyhanna, Pa., project architects Gilboy & O'Malley of Philadelphia specified 585 of the top lighting units shown during installation. These units—Wascolite Skydomes, a product of Wasco Flashing Co.—are 64 x 94 in. and have a rise of 19 in. which prevents obstruction by snow, and makes them self-cleaning during rains.

Installation was simple according to Merritt-Chapman & Scott Corp., constructors. A frame of extruded aluminum was screwed to a wood border around an opening. The dome was set over this and then a second aluminum frame placed over the edge of the plaster and screwed down with neoprene washers and gaskets as a seal.

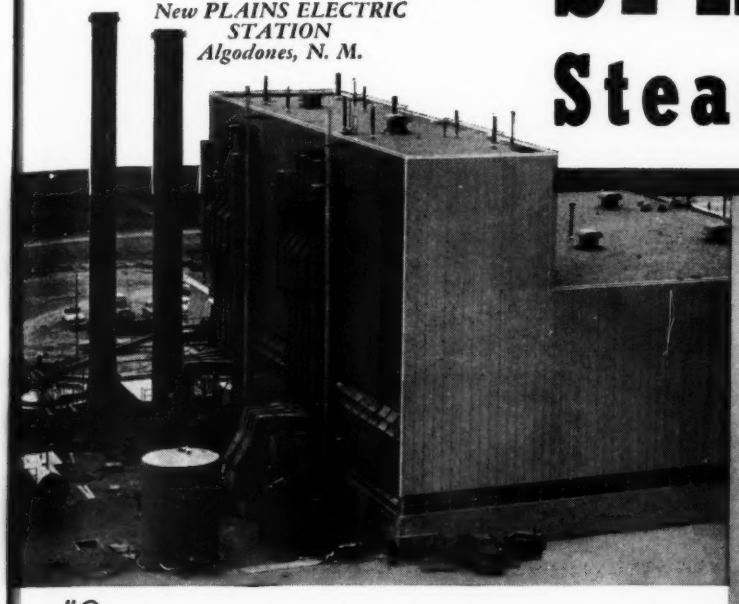


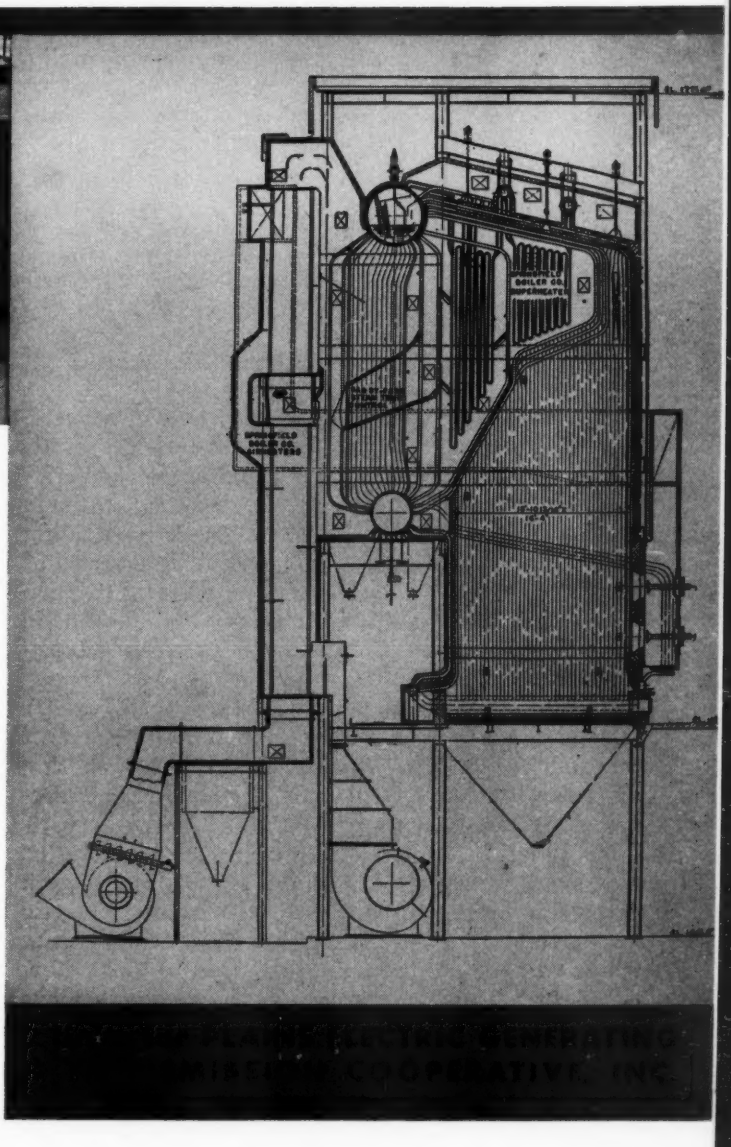
PLASTIC DOME IS PLACED ON ALUMINUM FRAME.

When natural lighting is not used or must be supplemented the trend is to fluorescent lamps. Ex-

Another New Installation of
SPRINGFIELD
Steam Generators...

New PLAINS ELECTRIC STATION
Algodones, N. M.





"Our project supplies electric energy to eleven of the seventeen distribution cooperatives in the state of New Mexico and to one in southern Colorado," writes Norton Davis, Manager, PLAINS ELECTRIC GENERATION AND TRANSMISSION COOPERATIVE, INC. *"This project was built with the primary idea in mind of supplying the much needed, economical electric power in the area served by our member distribution cooperatives. It, therefore, follows that a great deal of study was given to the selection of all major equipment with an eye to economy and reliability of operation."*

Numerous ingenious and advanced features are incorporated in the design of the Springfield Steam Generators furnished for the new Algodones, N. M., plant. In addition to automatic superheater temperature control, provision is made for control of flue gas temperature above dew point in airheater on low loads. The steam washer is of Springfield patented design and all provisions are made for future spreader stoker firing with economizer and dust collector ahead of I. D. fan, if desired. As shown in the above photograph, the generators are placed so that the unit rear walls form a portion of the building wall.

Find out about the broad range of service SPRINGFIELD offers—from small, standardized PACKAGE BOILERS to large, specially designed STEAM GENERATING UNITS. *Your inquiry will receive prompt attention.*

Continuous Steam Capacity, Each Unit	**160,000 lb/hr.**
Maximum Steam Capacity (2-hr. peak) Each Unit	**180,000 lb/hr.**
Boiler Design Pressure*	**950 psig**
Operating Pressure, at Superheater Outlet	**875 psig**
Final Steam Temperature (Controlled)	**910° F.**
Maximum Heat Release	**29,900 Btu/cf/hr.**
Heat Recovery:	**Springfield Two-Section Tubular Airheater. Provisions for future Springfield Steel Tube Economizer.**
Type of Firing	**Gas and/or Oil (Future coal)**
Installation	**Semi-Outdoor**

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Consulting Engineer:
LARAMORE and DOUGLASS, INC.
Chicago, Illinois

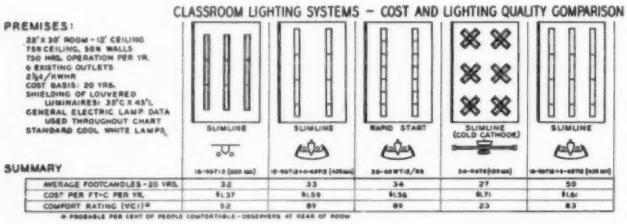
Check with your Consulting Engineer on Modernization and New Plant Projects

Well Lighted Buildings

—*Starts on page 62*

posed fluorescent lamp fixtures cost less and are cheaper to maintain, but louvered fixtures are handsomer and generally more comfortable to live with. Then there is the question of whether to use hot- or cold-cathode lamps.

Several interesting facts about school lighting become apparent upon studying the chart prepared by Carl Allen of the Lamp Div. of General Electric Co. The louvered systems are rated as visually


CLASSROOM LIGHTING SYSTEMS – COST AND LIGHTING QUALITY COMPARISON

PREMISES:
22'X 30' ROOM - 12' CEILING
75% CEILING, 50% WALLS
750 HRS. OPERATION PER YR.
6 EXISTING OUTLETS
2½¢/KWHR
COST BASIS: 20 YRS.
SHIELDING OF LOUVERED LUMINAIRES: 30°C X 45°L
GENERAL ELECTRIC LAMP DATA USED THROUGHOUT CHART
STANDARD COOL WHITE LAMPS

	SLIMLINE	SLIMLINE	RAPID START	SLIMLINE (COLD CATHODE)	SLIMLINE
SUMMARY					
AVERAGE FOOTCANDLES - 20 YRS.	32	33	34	27	50
COST PER FT-C PER YR.	$1.37	$1.59	$1.56	$1.71	$1.61
COMFORT RATING (VCI)*	52	89	89	23	83

* PROBABLE PER CENT OF PEOPLE COMFORTABLE - OBSERVERS AT REAR OF ROOM

PORTION OF CHART SHOWS LAMP TYPES TESTED.

comfortable by 83 to 89 percent of the observers. Only 23 percent rated the bare cold-cathode installations as comfortable (at 120 milliamps); 52 percent were comfortable with the bare hot-cathode (at 200 milliamps). The difference in comfort rating between the last two systems is not because of any difference between the light emitted by the two lamps but because the brightness of the cold-cathode tube was decreased by turning it partially lengthwise with respect to the line of view.

Only a portion of the chart is reproduced here. A copy of the complete chart may be obtained free of charge by writing for Vol. II, No. 4 of "The Lighting Engineer," General Electric Co., Nela Park, Cleveland 12, Ohio.

Not only for schools, but for offices, stores, or wherever else operation of fluorescent lamps at a variety of brightnesses is desired, General Electric has developed a new, simplified, low-cost dimmer which will control the light output of up to 20, 40-w rapid-start lamps at one time. The system employs a simple electrical control device of the type commonly available for dimming incandescent lamps, in combination with a special rapid-start ballast.

The Lamp Div. of G. E., at Nela Park, will be glad to send further information on request.

Wisconsin Registration Board Clarifies Directory Listings

After receiving complaints that unqualified persons and firms were confusing the public by styling themselves as engineers or architects, the Wisconsin Registration Board of Architects and Professional Engineers has drawn up an interpretation of Wisconsin law regarding listing in directories and telephone books as follows:

¶ Under the main heading of "architects," only persons with current registration in Wisconsin should be listed. Others may list themselves as "designers" or "home designers."

¶ Under the main heading of "engineers—registered professional," only those may be listed who hold current registration in the state. For subheadings, only names of recognized branches of engineering should be used, as "chemical, civil, electrical."

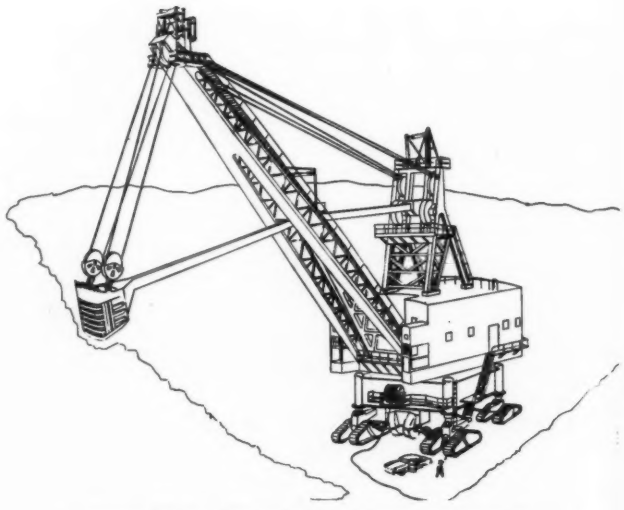
¶ Main headings or subheadings such as "hoisting engineer," and "stationary engineer," may be used in a listing providing they are placed in their proper alphabetical order, do not have "engineer" as the first word in such headings, and provided the listing does not contain in part a recognized branch of professional engineering as above described.

Board chairman Kurt Wendt, dean of the University of Wisconsin College of Engineering, said he expected the board would take action against unqualified persons who continue to list themselves contrary to the interpretation.

Special Events and Exhibits Planned for Power Show

The 21st National Exposition of Power and Mechanical Engineering, to be held at Philadelphia, Dec. 2 to 7, promises to be the big meeting of the year. Special events include an inspection trip through the Fairless Works of U. S. Steel Corp., Friday, Dec. 3 for engineers attending ASME's Annual Meeting in New York City, Nov. 28 to Dec 3. The group will be taken from New York to U. S. Steel and then on to Philadelphia.

Also on Friday will be an all-day symposium on automation to be held by the Instrument Society of America covering Trends, New Problems Created by Automation, Automatic Intelligence.

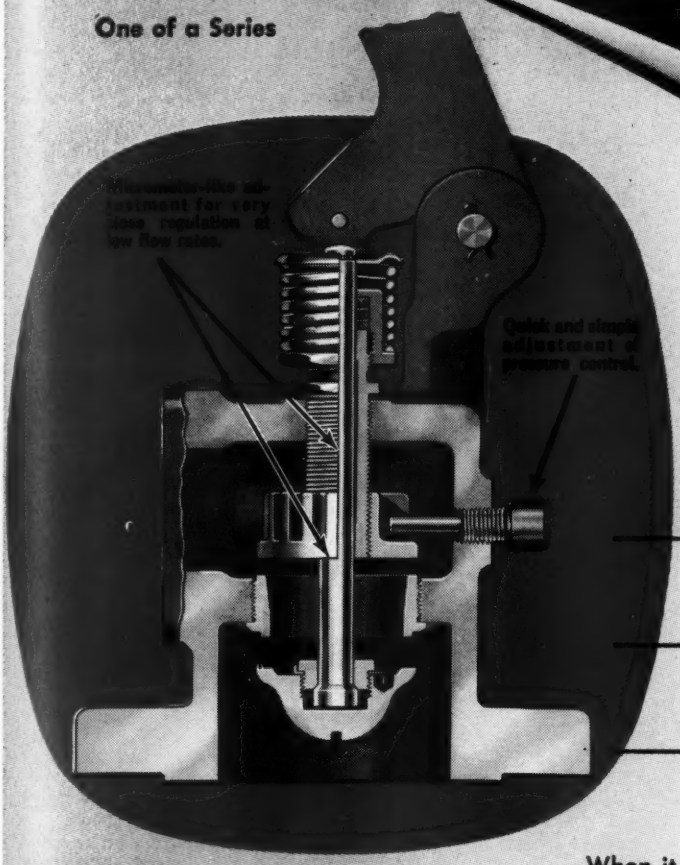


TWELVE-STORY-HIGH STRIPPING SHOVEL

This shovel, being built for Hanna Coal Co., Div. Pittsburgh Consolidation Coal Co. by Marion Shovel Co. marks a new development in power distribution for coal-stripping shovels. Power will be transmitted through a 250 MCM, type SHD, rubber armored, trailing cable at 6.9 kv, from a 5000 kva, 69,000-6900 v, portable, General Electric substation.

One of a Series

Reasons Why **DIAMOND BLOWERS Assure CLEANER BOILERS at LOWER COST**

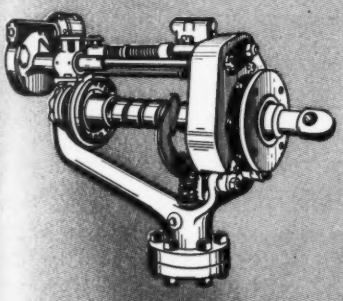

Micrometer-like adjustment for very close regulation at low flow rates.
Quick and simple adjustment of pressure control.

ADJUSTABLE PRESSURE CONTROL

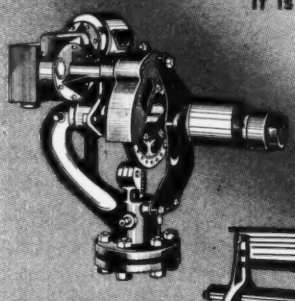
When it is necessary to reduce blowing medium pressure to proper blowing range, the Diamond Adjustable Pressure Control device offers the utmost in economy, convenience, accuracy and dependability. It is fully effective even at very low flow rates.

Adjustment is readily made without removing the valve or opening flanges. Simply take out the plug and insert a screw driver; use the serrations on the control disc to screw it up for higher blowing pressure . . . down for lower pressure. Full valve opening is always maintained thus avoiding wire drawing. Throttling is at the back seat so that the main seat is spared this damaging action. No orifice is needed in the line.

The Adjustable Pressure Control is one of a number of features of Diamond Blowers which provide better boiler cleaning at lower cost. It is standard on Models G9B, IR and IK. Write for Bulletins.



Diamond Model IR
Short Retracting Blower

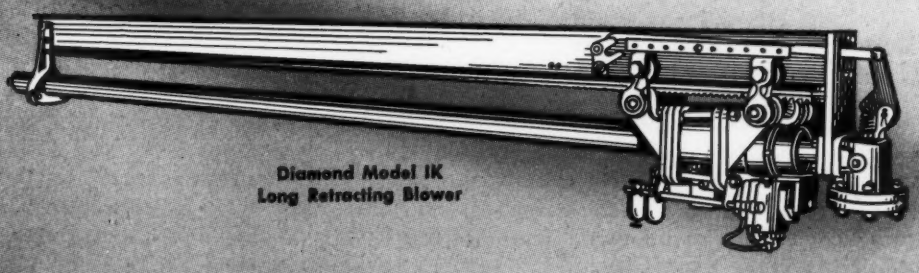


Diamond Model G9B
Automatic Valved Blower

DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

Diamond Specialty Limited, Windsor, Ontario



Diamond Model IK
Long Retracting Blower

6775

Power Show Plans

—Starts on page 64

Gathering Systems, and an analysis of The Engineering Control Loop.

Some 300 manufacturers have arranged for exhibits, many of which will include products displayed for the first time. Among these are an Autolog which records operating performances at as many as 50 trouble spots in plant operation; an electric boiler of British origin; and a line of instruments designed for DC over-potential testing.

Inquiries should be addressed to Publicity Department, 21st National Power Show, 480 Lexington Ave., New York 17, N. Y.

CONSULTING ENGINEER will be located at Booth 338 at the Power Show. Readers are invited to visit us there.

AICE Takes Stand Against Competitive Bidding

With the controversy over competitive bidding for engineering services still waging, the Council on the American Institute of Consulting Engineers at its October 6 meeting adopted the following Interpretation of Principle:

"The procurement of professional engineering services through competitive bidding on a price basis is a repudiation of the status of engineering as a profession, and the American Institute of Consulting Engineers hereby places itself on record as unalterably opposed to such practice.

"Competitive bidding for engineering services is not in the public interest since it may lead to the employment of the engineer least qualified for the particular work under consideration instead of the best qualified, which should be the objective. The public inevitably suffers from the selection of an unqualified engineer through engineering design which results in uneconomical construction or an unsafe structure.

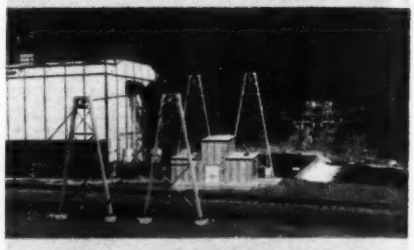
"The Institute subscribes to the procedure of procuring professional engineering services through negotiation between the principal and the engineer in such a manner that the interests of both parties and the interests of the public, where the public is involved, shall be protected."

See "How Professional Is Engineering?" CE, Oct., 1954, p 36.

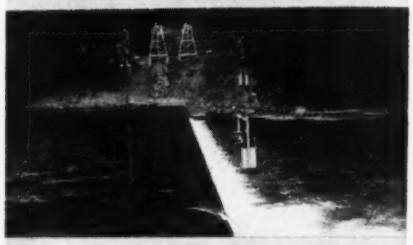
Dr. James Creese to Speak at AICE December Meeting

The December 1 luncheon meeting of the American Institute of Consulting Engineers will feature as speaker Dr. James Creese, president of Drexel Institute of Technology. Dr. Creese will speak on "The Liberalizing Promise of Science." Place is the Engineers' Club, New York City.

PENNSYLVANIA ELECTRIC GENERATING PLANT, COOLING TOWER, AND DAM MADE OF STEEL GATES.

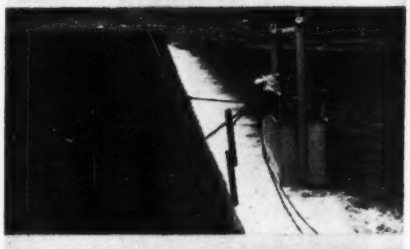


DUAL SAUERMAN TAUTLINE CABLEWAYS CARRY CREW AND HOOKS TO RAISE AND LOWER GATES.

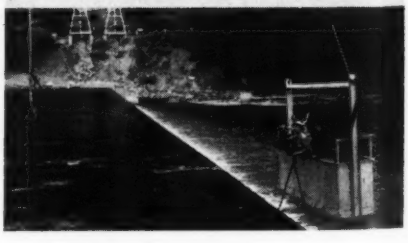


UPSTREAM CABLEWAY BRINGS OUT HOOK; DOWNSTREAM CABLEWAY CARRIES THE MEN AND EQUIPMENT.

HOOK IS LOWERED AND PLACED IN PROPER POSITION TO LIFT FALLEN GATE.



CREW STARTS TO INSERT SUPPORTING STRUT UNDER THE GATE.



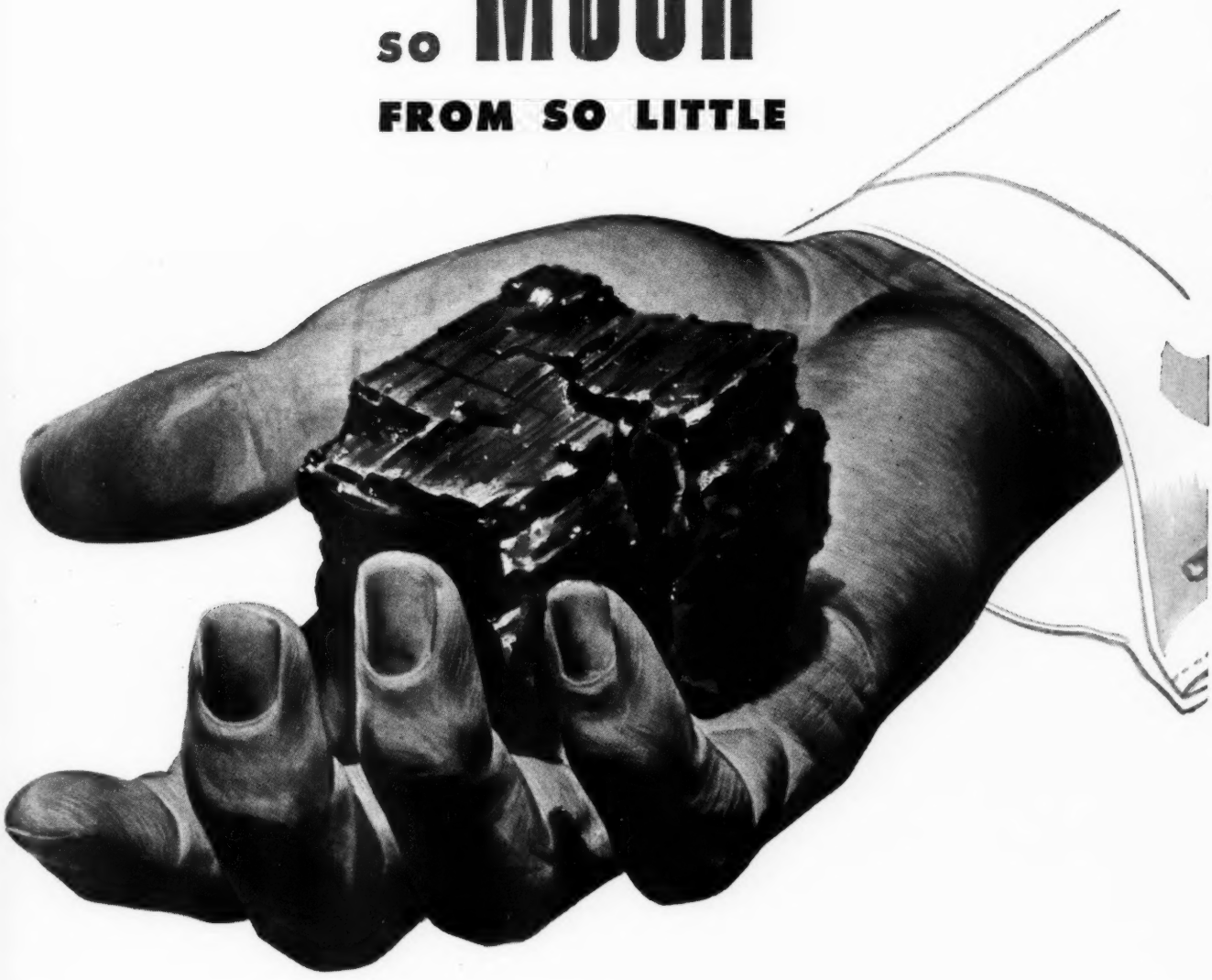
WITH GATE BACK IN PROPER POSITION, HOOK AND CREW ARE CONVEYED BACK TO SHORE STATION.

Maintenance Crew Controls Dam Gates From Cableway

With the installation of an induced-draft cooling tower capable of cooling 52,000 gpm from 115 to 85 F, Pennsylvania Electric's Shawville Plant faced the problem of maintaining river height at the required depth for efficient condenser operation. Considerations of economy of construction and ease of maintenance were met with a dam made up of 54 hinged steel gates, each six ft high.

Twin Sauerman cableways, which carry men and equipment to the gates, are controlled by two hoists powered by a 40 hp Westinghouse motor. ▲▲

SO MUCH
FROM SO LITTLE



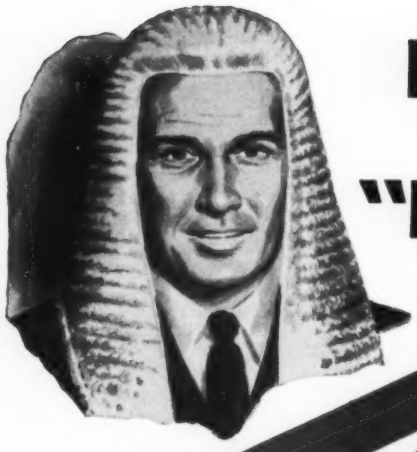
You're looking at a kilowatt-hour* of electricity in its raw state — coal. This lump of coal weighs only 12 ounces. Not too long ago, the amount of coal required to produce a single kilowatt-hour of electricity was considerably larger and weighed 5 pounds. The difference between yesterday's 5 pounds and today's 12 ounces lies in improved steam technology, in better boilers — operating at higher pressures and temperatures — to make the steam that spins the turbines to make electric power.

Impressive as this progress appears, it represents only the current level of accomplishment in the quest for more and still more efficiency. Thanks to America's power engineers, continuing advances in the fields of metallurgy, combustion and design will make it possible to squeeze even more energy from a lump of coal.

*A kilowatt hour will give you the power for, among other things, 10 solid hours of radio and recorded music, 14 hours of fan-cooling, better than 4½ hours of refrigerator operation.

BABCOCK & WILCOX
BOILER DIVISION

N-189



He's a "K.C."

KING'S COUNSEL

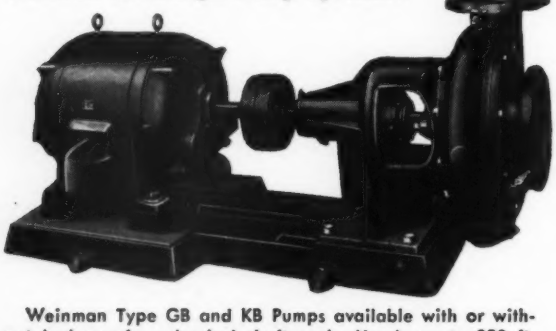
He's a C.P.S.

CENTRIFUGAL PUMP SPECIALIST

Both are experts in their field . . . and a Weinman C.P.S. is ready to aid you in YOURS!

A picturesque wig and silk robe announces the presence of a King's Counsel . . . a distinguished legal expert of the highest rank.

But in this country of ours, those who know easily recognize and welcome the expert counsel of a Weinman Centrifugal Pump Specialist, for wherever liquid-handling problems occur, his recommendations and guidance are invaluable. He knows from long experience how your pumping costs can be reduced . . . by supplying proper pumps to fit your specific needs . . . pumps that are reliable, with ample capacity to insure efficient operation, plus handling possible increased future demands. To successfully solve any pump problem, get the benefit of the best counseling available . . . from a Weinman Centrifugal Pump Specialist!



Weinman Type GB and KB Pumps available with or without leak-proof mechanical shaft seals. Heads up to 200 ft. Capacities up to 1700 GPM.

Representatives in principal cities

The WEINMAN Pump Mfg. Co.

A Matter of Ethics

CONSULTING ENGINEER *will pay $10.00 for each published example of problems of professional ethics sent in by readers.*

Another $10.00 will be paid for the best discussion of the problem published in this column each month.

A CONSULTING FIRM, Smith & Jones, Engineers, took a job of designing a large warehouse for the Andrews Manufacturing Company. So far as basic design was concerned, the job seemed fairly routine. The building was to be of simple industrial construction and was to be built on the site of a former warehouse which had been destroyed by fire several years before. The client insisted on fixed lump sum fee, and because of the routine nature of the job, Smith and Jones agreed. They calculated their fee on the basis of 6 percent of net construction cost, which was estimated at $250,000. The fee, therefore, amounted to $15,000. Smith and Jones figured that out of this fee they should have a net profit of perhaps $1000 to $1500.

Part of the cost of construction was the cost of driving piles for foundation support, the site being sandy and marshy in spots.

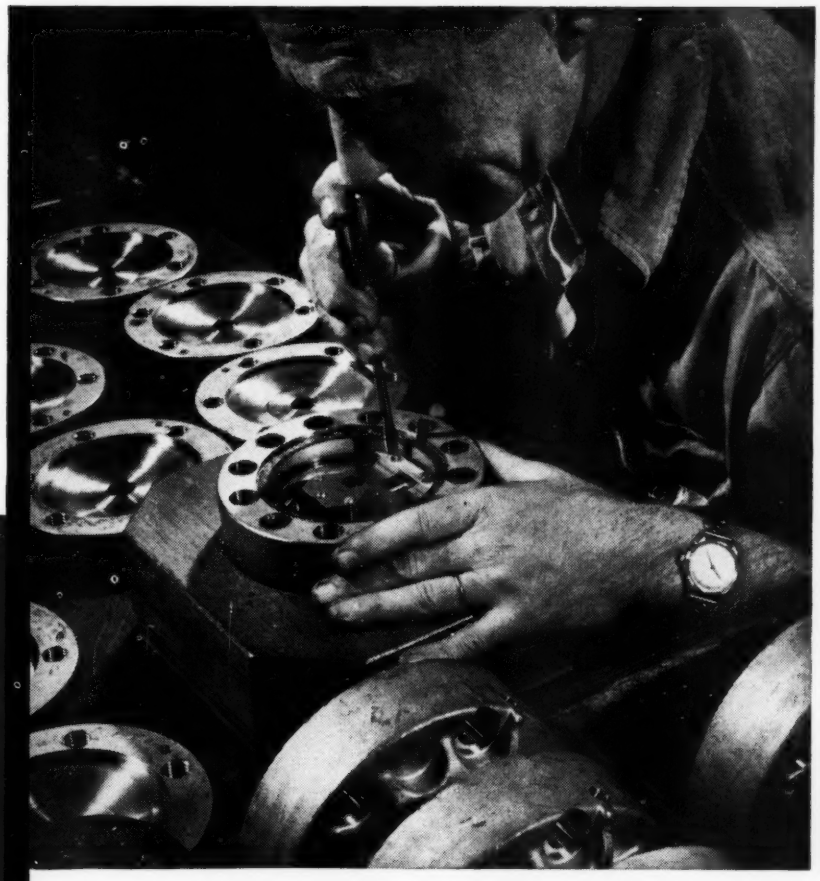
A few days before construction was to begin, a final survey of the site resulted in the discovery of old piling left from the former warehouse, in good condition and located so that it could be used for the new warehouse. However, the use of the old piling, with its particular spacing, would require a whole new set of calculations and new drawings.

What should Smith & Jones do? If they reworked the design, the cost to them would be about $8000, and that would mean a loss on the job of $6500 to $7000. But using the old piling would save the client about $30,000.

It would be a simple matter to tell the client that the old piling was not suitable for use—that new piling would have to be used. The client was planning on this and the cost to him would be only what he expected. Smith & Jones would then make their profit.

But Section 8, of the "Canon of Ethics for Engineers" clearly states, "The engineer will act in professional matters for each client or employer as a faithful agent or trustee." Surely this demands that as the client's trustee, Smith & Jones must save the client the cost of the unnecessary new piling even though it costs them several thousand dollars personally.

What would you do?



Yarway Remote Liquid Level Indicator with new raised wide-vision face. Write for Yarway Bulletin WG-1824.

THIS MAN IS WRITING BOILER INSURANCE

● Figuratively, that is.

He is a Yarway craftsman, assembling Yarway Remote Liquid Level Indicators . . . and the care he is taking is one of the reasons why Yarway Remote Indicators are just about the safest boiler insurance you can buy.

Every part is precision-machined. Every assembled instrument is precision-tested. In the Yarway Research Laboratory a stock indicator passed the equivalent of 100 years normal use with no parts replacements, no serious wear. In thousands of power plants, ashore and afloat, Yarway Indicators are giving similar dependable service.

This is typical. All Yarway products contain the same good engineering and skilled workmanship, aimed at one objective—better service in your plant.

Make Yarway your way.

YARNALL-WARING COMPANY
106 MERMAID AVENUE, PHILADELPHIA 18, PA.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY steam plant equipment

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
REMOTE LIQUID LEVEL INDICATORS
EXPANSION JOINTS
DIGESTER VALVES
STEAM TRAPS
STRAINERS
SPRAY NOZZLES

ILLCO-WAY
ionXchange

~~SiO_2~~

REMOVE SILICA
BY DE-IONIZATION

One of the toughest problems in treating water for use in high-pressure steam systems is the *complete* removal of silica. One of the easiest ways to solve this problem is to use an ILLCO-WAY ionXchange system.

GET CLEAN HIGH-PRESSURE STEAM

Not only does ILLCO-WAY ionXchange equipment remove the silica, but it also removes *all other* dissolved solids — producing a really *clean* water for the generation of high-pressure steam. (Chemically, the water is the equivalent of triple-distilled.) Furthermore, the design and construction of ILLCO-WAY equipment is based on a wealth of practical experience dating from the very first year that modern ionXchange resins became available.

REDUCE COSTS

A comparison of costs, taking all factors into consideration, shows that the ionXchange method is more economical. This, with other advantages of completely de-mineralized water, can result in noticeable reductions in your operating cost. *Let us show you the details.*

ILLINOIS WATER TREATMENT CO.
ionXchange
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833 CEDAR ST.
ROCKFORD,
ILLINOIS
NEW YORK OFFICE: 141 E. 44TH ST. NEW YORK 17, N. Y.
CANADIAN DIST. PUMPS & SOFTENERS, LTD. LONDON, ONT.

IN ENGINEERING

★ P. G. Uhlmann, superintendent of electric and steam heat sales for the Springfield Div. of Ohio Edison Co., is named a director of the Springfield Development Council, a non-profit organization dedicated to promoting Springfield's plant sites for industrial use.

★ Argonne National Laboratory announces selection of Sargent & Lundy, Chicago, as architect-engineer for design of the Experimental Boiling Water Reactor which has been authorized as part of AEC's five-year program for development of competitive electrical power from nuclear fuel.

★ Edmund B. Besselievre will serve as manager of the newly organized Industrial Wastes Div. of Kaighin & Hughes, piping and mechanical contractors, Toledo, Ohio.

★ H. W. Heisterkamp and R. J. de Fasselle, the two principals in the consulting engineering firm of Spengler Associates, are now operating under the firm name of Heisterkamp & de Fasselle. Address is P. O. Box 98, Cleveland 21, Ohio.

★ George Roberg Thompson is appointed to the executive staff of Giffels & Vallet, Inc., L. Rossetti, associated engineers and architects of Detroit. Thompson recently retired as Detroit's city engineer, a position he held for 17 years.

★ Kaiser Engineers Div. of Henry J. Kaiser Co. announces the addition of three new engineers to its staff. Colonel H. George Gerdes (U. S. Army-Ret.) is appointed power engineer assigned to the hydroelectric power development program. K. J. Caplan joins the staff as an air pollution engineer. And Patrick J. Selak is appointed to the company's atomic energy division.

★ Michael Pope announces the opening of his office at 101 Park Avenue, New York City. During his long association with the late David Moffat Myers, he specialized in the field of industrial steam and power.

★ Dr. Charles J. Kensler, pharmacologist and biochemist, joins the staff of Arthur D. Little, Inc. He will organize and expand the biology department to offer increased research services in the fields of pharmacology, biochemistry, toxicology, enzymology, nutrition, and hygiene.

Germer Spanner

★ The Franklin Institute of the State of Pennsylvania has awarded its Frank P. Brown Medal to Dr. Edmund Germer, consulting engineer of Irvington, N. J., and to Dr. Hans J. Spanner, consultant of Zurich, Switzerland. Both men received the medal in consideration of their outstanding contributions in the development of the fluorescent lamp.

★ Ebasco Services Inc. has opened an office in Portland, Oregon. William F. Rooney will be in charge.

Eric Ruckelshaus has joined Ebasco as senior business consultant, and Lee Hanower joins the company as a business analyst in the petrochemical and plastics field.

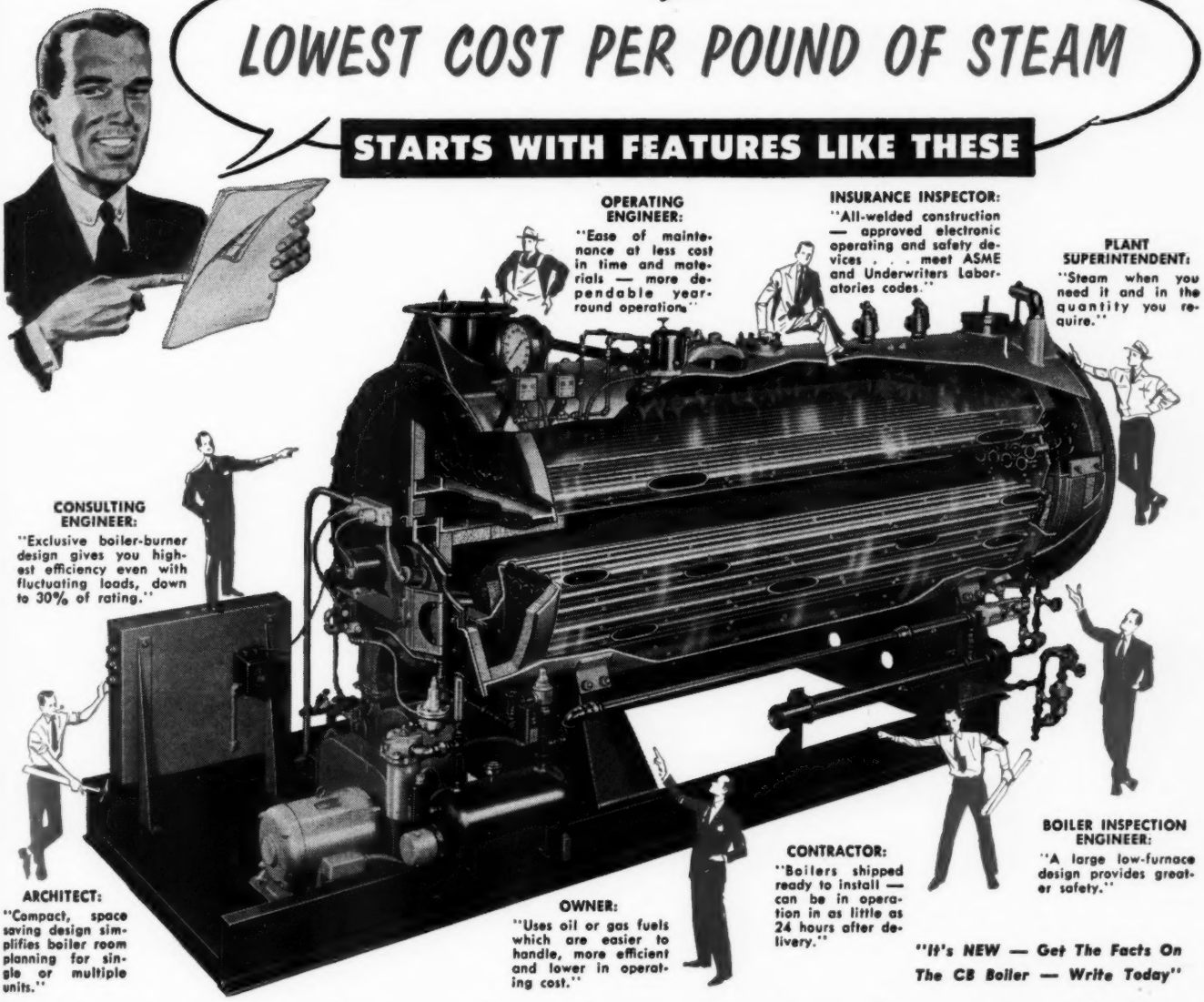
★ Dr. Howard W. Barlow, former dean of engineering at Texas A & M, is now director of the Washington State Institute of Technology of the State College of Washington.

★ Ray Tanis joins the National Accounts Div., of the Dearborn Chemical Co. to act as a liaison between the company's technical staff and consulting engineering firms.

★ Baldwin-Gregory Co., located at 121 Kemp Ave., Fair Haven, N. J. has recently been formed as a consulting firm on hot dip galvanizing problems.

LOWEST COST PER POUND OF STEAM

STARTS WITH FEATURES LIKE THESE


OPERATING ENGINEER:
"Ease of maintenance at less cost in time and materials — more dependable year-round operation."
INSURANCE INSPECTOR:
"All-welded construction — approved electronic operating and safety devices . . . meet ASME and Underwriters Laboratories codes."
PLANT SUPERINTENDENT:
"Steam when you need it and in the quantity you require."
CONSULTING ENGINEER:
"Exclusive boiler-burner design gives you highest efficiency even with fluctuating loads, down to 30% of rating."
ARCHITECT:
"Compact, space saving design simplifies boiler room planning for single or multiple units."
OWNER:
"Uses oil or gas fuels which are easier to handle, more efficient and lower in operating cost."
CONTRACTOR:
"Boilers shipped ready to install — can be in operation in as little as 24 hours after delivery."
BOILER INSPECTION ENGINEER:
"A large low-furnace design provides greater safety."

"It's NEW — Get The Facts On The CB Boiler — Write Today"

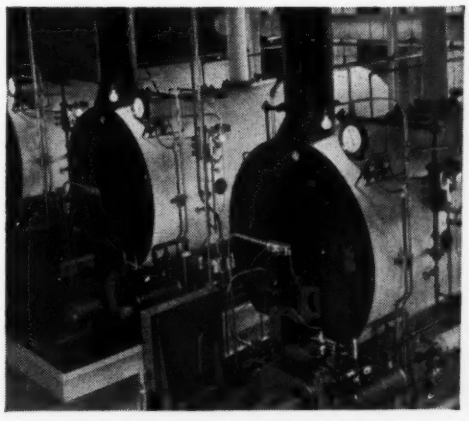
that's why you profit most from Cleaver-Brooks self-contained boilers

• Top to bottom, inside and out, you get more money-saving features when you specify or buy Cleaver-Brooks self-contained boilers. You make an *investment in quality* that pays off in lowest net cost per pound of steam for processing or heating.

YOU BENEFIT from more than 20 years of experience, working closely with men who have made it their business to be *right* about boilers. You profit from complete coordination throughout planning, installing, supervising and final operation.

YOU BENEFIT from self-contained design and original four-pass construction. These Cleaver-Brooks engineered "firsts," plus forced draft, 5 sq. ft. of heating surface per boiler hp, and exclusive burners, all contribute to highest heat transfer. Guaranteed 80% thermal efficiency when firing with oil is the direct result!

Whether you're planning a new steam plant or modernizing, make certain you get the complete Cleaver-Brooks story before you buy. See your Cleaver-Brooks representative, or write for catalog AD-100. Cleaver-Brooks Company, Dept. M-320, 326 East Keefe Avenue, Milwaukee 12, Wisconsin, U.S.A. *Cable Address CLEBRO — Milwaukee — All Codes.*



One typical owner can count on yearly savings ($15,000 fuel and $10,000 labor) from this battery of three 150 hp Cleaver-Brooks self-contained boilers.

•

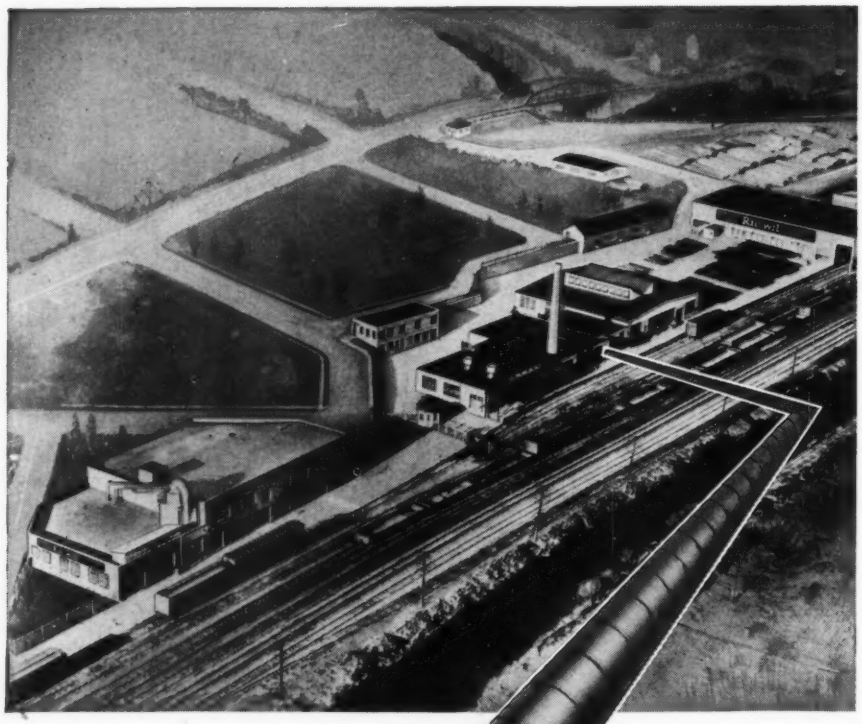
NOW — FIRST SIZES OF THE CB BOILER ARE MADE IN CANADA, TOO.

•

Cleaver Brooks

ORIGINATORS OF THE SELF-CONTAINED BOILER

BOILERS . . . STEAM OR HOT WATER . . . FOR HEATING OR PROCESSING, IN SIZES FROM 15 TO 500 hp, 15 to 250 PSI.



NEVER ENDING LINE OF

Quality

The Ric-wil Company represents over 40 years of manufacturing Quality Insulated piping systems. The complete Ric-wil product line is continuously pre-proven by laboratory and field tests to maintain this superior quality.

Contact your local Ric-wil representative or write direct for Catalog No. 5401.

Send for Catalog 5401

Quality Piping Systems of the . . .
. . . Highest Thermal Efficiency

RIC-WIL PREFABRICATED INSULATED PIPING SYSTEMS

THE RIC-WIL COMPANY
BARBERTON, OHIO

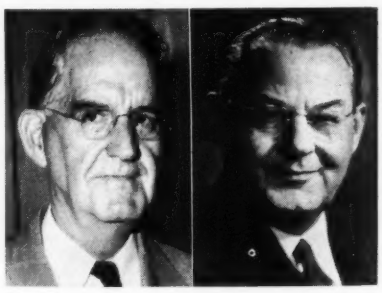
MEN

—Starts on page 70

Principals are Allen T. Baldwin, manager of Flux Sales with Hanson-Van Winkle-Manning Co., and William P. Gregory, vice president of New Jersey Galvanizing and Tinning Works, Inc. Both men will retain these positions in addition to functioning as executives at Balwin-Gregory Co.

★ Broderick Haskell, vice chairman of Combustion Engineering, Inc., and J. L. Atwood, president of North American Aviation, Inc., are elected directors of the Atomic Industrial Forum, Inc. Admiral Earle W. Mills, president of Foster Wheeler Corp., is elected a vice president of the Forum. Walker L. Cisler, president of Detroit Edison Co., is re-elected president of the Forum.

★ New officers of the American Society of Civil Engineers are: William Roy Glidden, assistant chief engineer of the Virginia Department of Highways, president; Frank L. Weaver, Division of River Basins, Bureau of Power, Federal Power Commission, vice president; and Louis R. Howson, partner in Alvord, Burdick & Howson, vice president.

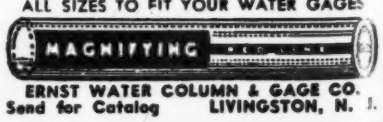


Glidden **Miehls**

★ George H. Miehls, president of Albert Kahn Associated Architects & Engineers, was guest lecturer for a two-day seminar in architecture and engineering at the University of Kansas, held October 25 and 26.

FOR SALE

GAGE GLASSES AND
High Pressure Rubber Gaskets
ALL SIZES TO FIT YOUR WATER GAGES



ERNST WATER COLUMN & GAGE CO.
Send for Catalog LIVINGSTON, N. J.

may you never need it . . . but . . .

. . . if you do, this is the fire pump you can depend on, Fairbanks-Morse. And where else is quality, dependability more important than in a fire pump. True, they may never be called upon . . . true, they may operate but seldom, but when they are needed, they *must* be ready.

That is why no design, material or manufacturing step that can contribute to reliability . . . to unfailing operation . . . is overlooked.

That is why we say "may you never need it, but this pump will always be ready if you should."

For the fire pumps you can depend on, contact your nearby Fairbanks-Morse Branch, pump dealer, or Fairbanks, Morse & Co., world's largest manufacturer of a complete pump line, Chicago 5, Ill.

FAIRBANKS-MORSE

a name worth remembering when you want the best

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • RAIL CARS • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

Check the Liquid Level
From Anywhere in the Room
with the NEW CONVEX SCALE
Jerguson TRUSCALE
Remote Reading Gage
Available with Explosion Proof Illumination.
Compensated Manometric Gage meets new interpretation of the boiler code for WSP of 900 psi or higher.

You get full 180° visibility . . . so you can read the liquid level from any point from which you can see the gage . . . with the New Convex Scale now available on Jerguson Truscale Remote Reading Gages. Scale markings are directly on the convex face and the indicator goes clear around the convex surface. You can stand at one end of the control room and instantly check your whole line up of Truscale Gages.

Jerguson Truscales give you instant remote readings of liquid levels of waste heat boilers, tanks, etc. . . . with the amazing accuracy of ½ of 1% of scale reading. And with the New Convex Scale you make these readings from any angle . . . accurately, without distortion. Truscales also available with lights, horns and Truscale Repeaters.

Write today for complete data on Truscale Gages with the New Convex Scale.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

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Bailey Meters & Controls, Ltd., London, Eng.
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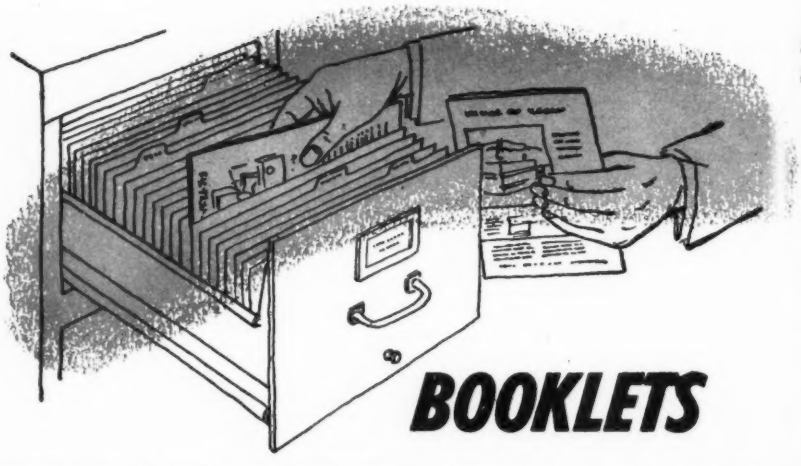


BOOKLETS

Personal copies of booklets can be obtained by writing directly to the manufacturers

"Daylighting Your School" presents a solution to the problem of adequate school illumination through the use of top-lighting with the Wascolite Skydome. An interesting feature is an illustrated section of typical school installations in relation to the classroom arrangement and day-light distribution. *Wasco Flashing Co., Dept. CE, 87 Fawcett St., Cambridge, Mass.*

Remote-Control Wiring manual 16-284 includes new components recently added to the remote-control line and complete technical and installation data on this modern low-voltage system of residential wiring. Intended for use by architects, electrical engineers, and contractors, it gives wiring diagrams, layouts, and much other useful information. *Construction Materials Div., General Electric Co., Dept. CE, Bridgeport 2, Conn.*

Blending, Processing, and Heat Exchange Equipment for the chemical and processing industries is pictured and described in bulletin 13. Twenty different cooling and heat exchange units are shown, many of which are devoted to specialized applications. *Patterson-Kelley Co., Inc., Dept. CE, E. Stroudsburgh, Pa.*

Magnetic Wire — Designed to replace Section 12 in Anaconda's general catalog, the new revised section on magnetic wire is now available as a separate booklet, 84 pages, designated as C-79-12. It incorporates changes under ASTM & NEMA standards. *Anaconda Wire & Cable Co., Dept. CE, 25 Broadway, N. Y.*

Proportioning Pumps — Six-page foldout AP-54 tells what the Hills-McCannameter is, why it was designed, what it will do, and how it works. *Hills-McCanna Co., Dept. CE, 3025 N. Western Ave., Chicago 18.*

Engineers Can Completely Plan, Specify, and Order the proper units to solve almost any problem involving moving, heating, or cooling of air with the use of these two, forty-page catalogs: 1620 on heating and ventilating units; and 1630 on air-conditioning units. *Westinghouse Electric Corp., Sturtevant Div., Dept. CE, T-126, 200 Readville St., Hyde Park, Boston 36, Mass.*

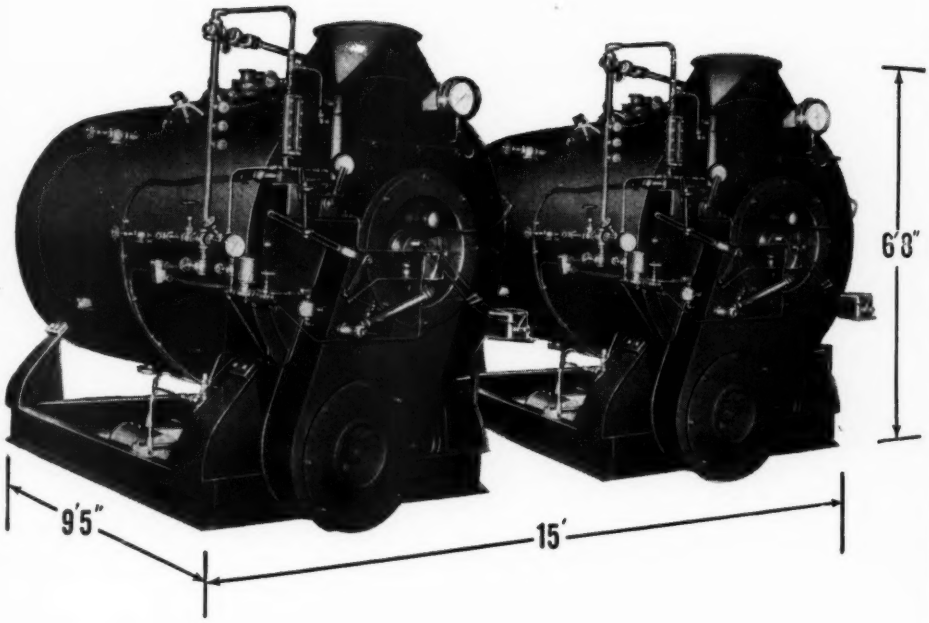
How Controlled Volume Pumps can be used as flow controllers, ratio controllers, and final control elements in process instrumentation is explained in 21-page booklet 1253. Valuable information on how fluid characteristics and piping effect operation of these pumps is included. *Milton Roy Co., Dept. CE, Station Y, 1300 E. Mermaid Ln., Philadelphia 18, Pa.*

Steam Cost Calculator—Made of heavy board, this slide rule calculator will enable you to read directly cost of steam per hp for installations using oil, coal, or gas. It also gives a direct reading of efficiency of system. *Hapman Dutton Co., Dept. CE, 683 Gibson St., Kalamazoo, Mich.*

Pressure Filters and Accessories used to remove suspended solids are discussed in detail in 15-page bulletin 2225B. All engineers dealing with water problems will want a copy of this. *The Permutit Co., Dept. CE, 330 W. 42nd St., N. Y. 36, N. Y.*

"Modern Mining Methods," 15-page booklet MS-977, gives a pictorial review of this company's line of industrial equipment as applied by the mining industry. How this modern equipment increases output

9600 lbs. of Steam in only 1000 cu. ft!



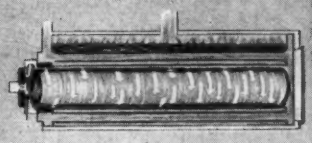
Using only 140 sq. ft. of Floor Space

The Cyclotherm MC4000 Steam Generator allows you to utilize your space more efficiently . . . to devote more of your area to storage and production use.

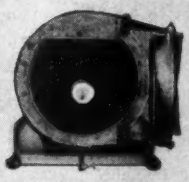
Requires the minimum in boiler room space and costs. Or can be placed in a working area because radiant heat loss is at a minimum. Exclusive, patented, Cyclotherm Cyclonic Combustion makes the most compact steam- generator yet developed possible.

A flaming cyclone swirls the length of the firetube . . . separated from the walls only by a thin layer of air. The even distribution of the flame converts the entire surface of the firetube into an effective heating area. Without increasing the boiler size, the heating area has been enlarged to the maximum.

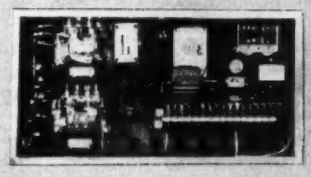
No other method of combustion can equal this accomplishment. The Cyclotherm MC4000 is ideally suited for service wherever steam is needed but boiler room space is at a premium.



Exclusive, patented Cyclonic Combustion gives you a minimum guaranteed 80% efficiency in only 2 passes . . . a rate unequalled by any other method of combustion.

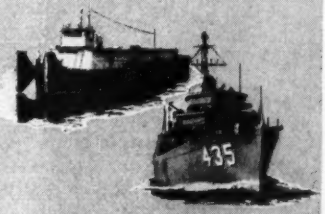


Simplified design shaves maintenance costs up to 50%. Cleaning and replacement of parts can be done in minutes by any maintenance man. Firetube never needs cleaning as all fuel is consumed.

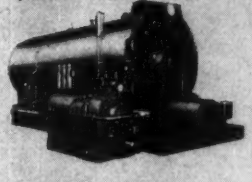


Automatically operates by electronic control system. No fireman required. Burns gas and/or oil. A Cyclotherm unit will pay for itself in 4½ years in fuel savings alone.

Precision modulation equipment regulates firing rate from 30 to 100% of the Cyclotherm's capacity without losing peak efficiency.



Now aboard Sinclair Refining Co.'s "Sinclair Chicago," and U. S. Navy's "U. S. S. Endurance" . . . operating efficiently in space too cramped for ordinary packaged units.



Other Cyclotherm models range from 18 to 500 hp . . . from 15 to 200 psi. For industrial, commercial plants, institutions and marine use.

YEARS AHEAD IN STEAM GENERATION

CYCLOTHERM®

STEAM AND HOT WATER GENERATORS

See Cyclotherm's new MC4000 Steam Generator at the

CYCLOTHERM EXHIBIT

Booth 450, 21st Power Exposition, Philadelphia, Dec. 2-7

Cyclotherm Division, U. S. Radiator Corp., Dept. 342, Oswego, New York

BOOKLETS —Starts on page 74

per man-hour is told. *Allis-Chalmers Mfg. Co., Tractor Div., Dept. CE, Milwaukee 1, Wis.*

"COOLING WATER FOR INDUSTRY," 36-page booklet CT-ID-0.002, covers the complete subject of cooling tower construction and application. *The Fluor Corp., Ltd., Dept. CE, Los Angeles 22, Calif.*

GENERATOR VOLTAGE REGULATORS are fully described in two booklets: 3090 on regulators for small and medium-sized a-c generators; and 3095 on regulators for medium and medium-large a-c generators. These are booklets you will want to keep within reach for reference purposes. *Brown Boveri Co., Dept. CE, 19 Rector St., N.Y. 6, N.Y.*

CONTROL AND MEASURING EQUIPMENT — Four-page flyer 050 gives general information on both primary and secondary measuring devices with short descriptions and characteristics of each. Included are elliptical Venturi tubes as well as parabolic flumes used as primary devices to actuate secondary indicating, recording, and totalizing units. *Simplex Valve & Meter Co., Dept. CE, 68th and Upland Sts., Phila. 42, Pa.*

TRANSLUCENT STRUCTURAL PANELS — Industrial, commercial, and residential uses for Ceilite panels are given in this four-page folder which includes complete specifications and corrugation drawings. *Ceilite Corp., Dept. CE, Box 278, Allison Park, Pa.*

FOR THE ASKING you can have, free, an 8 x 4 in. plastic-coated decimal equivalent chart or a wall-size chart measuring 16 x 23 in. *John Hassall, Inc., Dept. CE, Box 2253, Westbury, Long Island, N.Y.*

CATALOG 54B, 22 pages, deals with storage tanks and steel plate fabrication and features design data, foundation recommendations, computing tables, and much other general information. *Hammond Iron Works, Dept. CE, 630 Fifth Ave., N.Y. 20, N.Y.*

CONVECTORS — Catalog 703, 24 pages, contains detailed descriptions, specifications, construction and application information on Airtherm convectors. Tables and charts show capacities of various models. *Airtherm Mfg. Co., Dept. CE, 772 South Spring Ave., St. Louis, Mo.*

THE DIATOMITE FILTER, for installations requiring filtered water of extreme clarity, is described in bulletin 801. Horizontal multi-cel and vertical sand filters are also covered. *Elgin-Refinite Div. of Elgin Softener Corp., Dept. CE, Elgin, Ill.*

AIR BRAKE STARTERS — These units will pay for themselves if there is one fault according to eight-page foldout 1060. Three types are described: 50,000 kva interrupting capacities; with current-limiting power fuses; and Valimitor type for unlimited type short circuit protection. *The Electric Controller & Mfg. Co., Dept. CE, 2698 E. 98th St., Cleveland 4, Ohio.*

RIBBED INDUSTRIAL SIDING, a new aluminum product designed to achieve more attractive, low cost siding on industrial buildings, is described in data sheet 300-1. It includes drawings, structural details, and loading and coverage tables. *Aluminum Co. of America, Dept. CE, 1501 Alcoa Bldg., Pittsburgh 19, Pa.*

BOILERS — Four-page folder AD-135 completely describes the new CB boilers available in 50 to 80 hp

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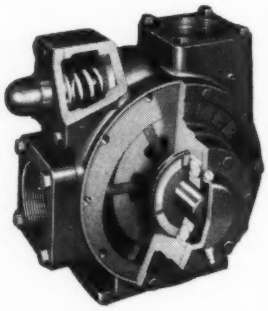

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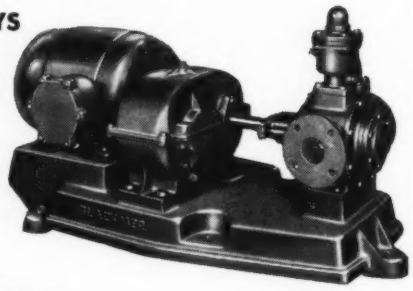

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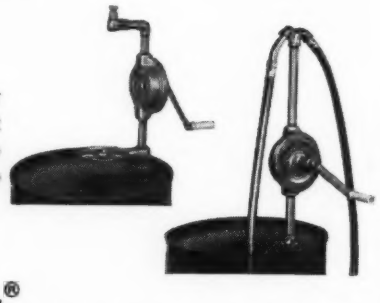

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This diagram illustrates how one direct-to-drum gage and two Reliance EYE-HYEs may be used according to Case No. 1155 code interpretation.

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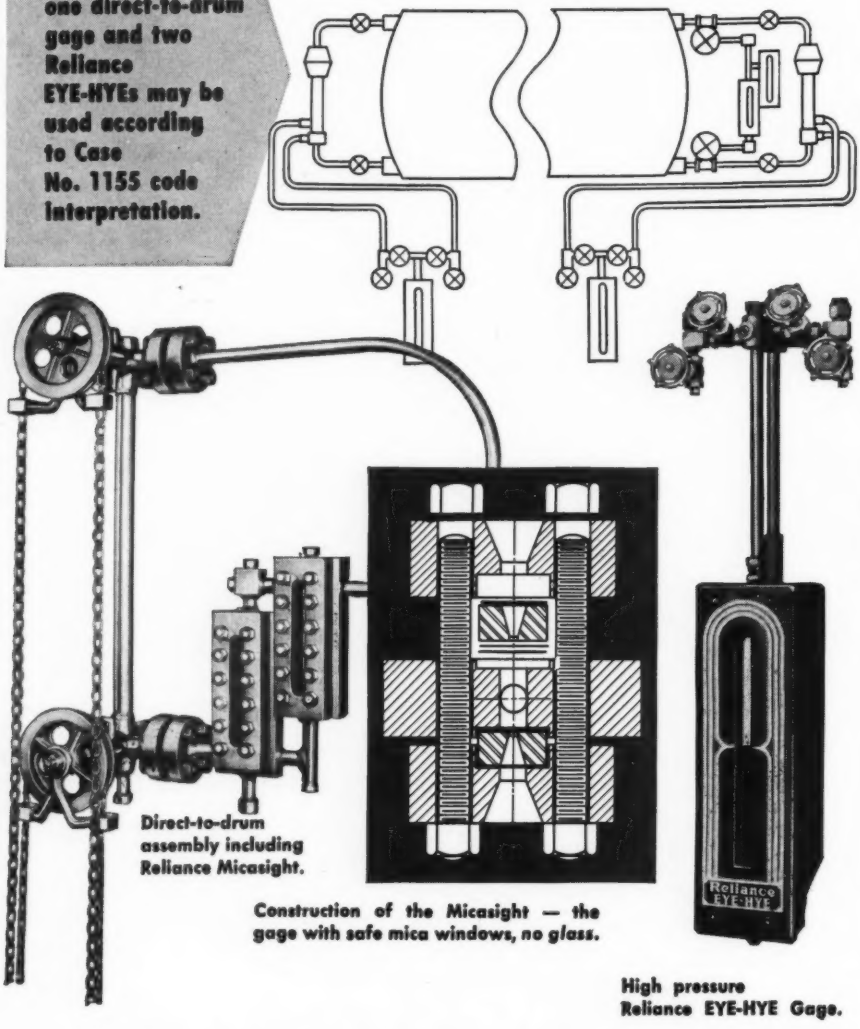

Direct-to-drum assembly including Reliance Micasight.

Construction of the Micasight — the gage with safe mica windows, no glass.

High pressure Reliance EYE-HYE Gage.

It pays you to be familiar with provisions of the reply given in Case 1155 (boiler code) leading to more efficient gage reading on boilers operating at 900 psi and over. The two required manometric gages can be the remote reading EYE-HYE that supplies convenient eye-height supervision at your panel board. A gage glass must still be available at the drum, but it may be shut off when both remote gages are operating.

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The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, Ohio

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BOILER SAFETY DEVICES

BOOKLETS —*Starts on page 74*

for heating and processing. It contains drawings and specifications on each of the models. *Cleaver-Brooks Co., Dept. CE, Milwaukee 12, Wis.*

VIBRATION MONITOR — A low cost dependable vibration-responsive device, the Vibraswitch, is described in four-page bulletin 500-1. The handy vibration nomograph can be clipped out for future reference. *The Beta Corp., Dept. CE, P. O. Box 8625, Richmond 26, Va.*

"DRAFTING STANDARDS - ALUMINUM EXTRUDED AND TUBULAR PRODUCTS" supercedes the first edition issued in 1949. Changes have been made to keep the manual abreast of advances in production and application methods. *The Aluminum Association, Dept. CE, 420 Lexington Ave., N.Y. 17, N.Y.*

WATER JET EDUCTORS — Comprehensive information on design, construction, application, and operation of the SK Water Jet Eductors is included in 36-page bulletin 2-M. Nomograph permits you to determine whether or not special SK Eductor might be applicable where a standard eductor will not do the job. *Schutte and Koerting Co., Dept. CE-J-M, Cornwells Heights, Bucks County, Pa.* ▲▲

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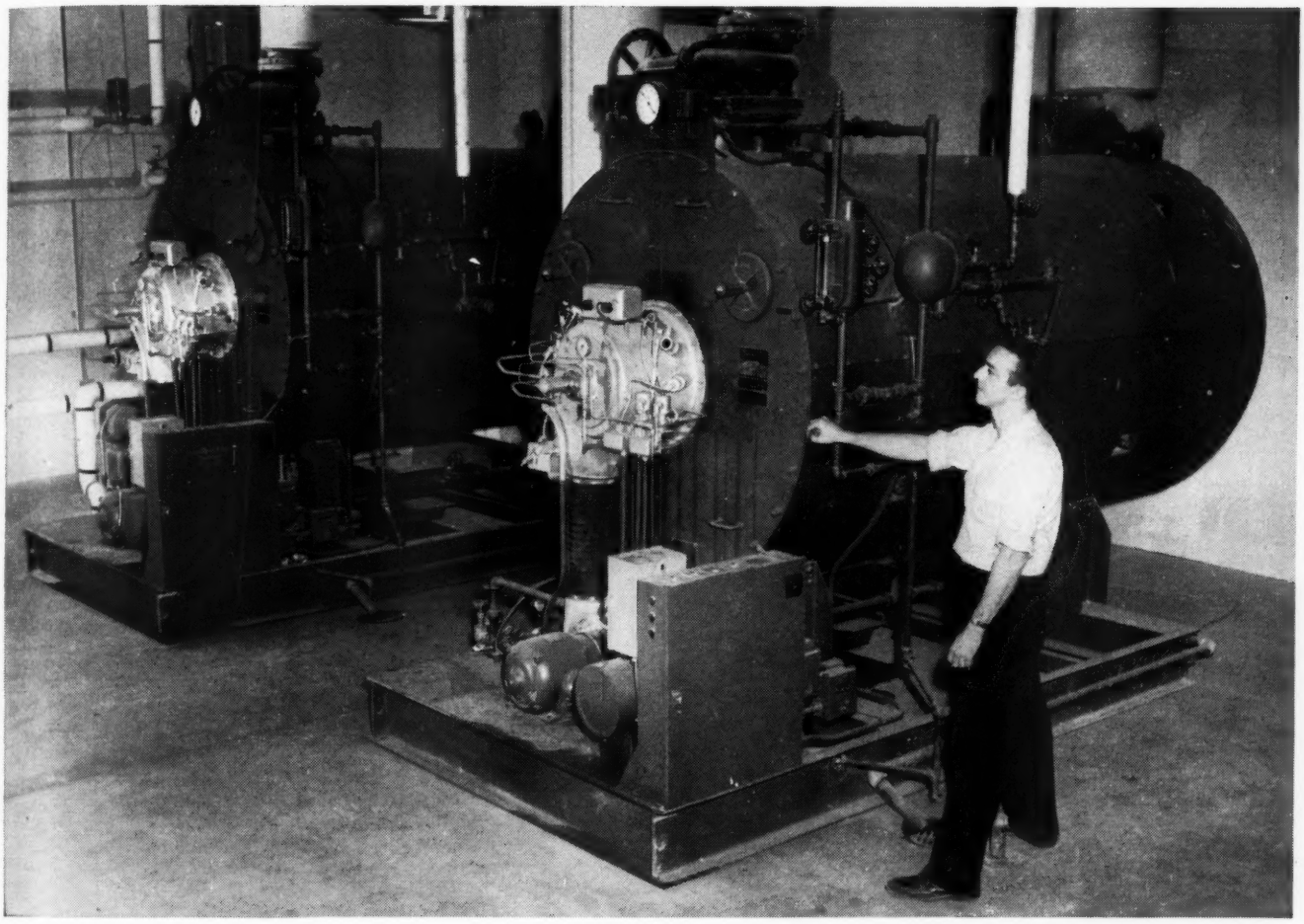

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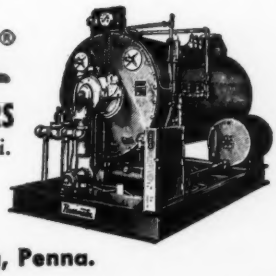


ORR & SEMBOWER, INC. • Established 1885 • **Morgantown Road, Reading, Penna.**

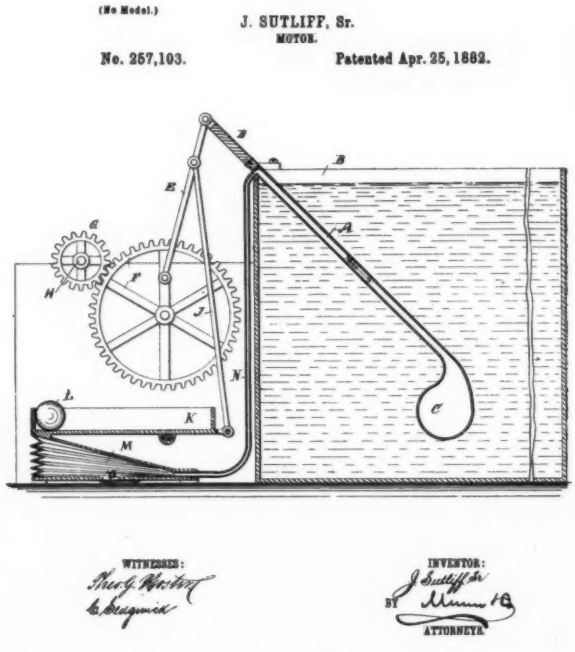
GENIUS AT WORK

SO LONG AS THERE ARE MEN, there will be inventive geniuses building and patenting perpetual motion machines. J. Sutliff, Sr., is just one among many, but his invention, simply titled "Motor", and patented in 1882, has some fascinating aspects.

In the position shown in the drawing, the bulb C is full of air and, therefore, will tend to rise in the tank of water. As it rises, it actuates, through lever A and eccentric E, the gear wheel F. This gear turns pinion G, and power is taken off from shaft H.

But that is not all. Connecting rod J will move downward as the bulb rises. This will shift the position of pivoted box K, so that the weighted ball L will roll down to the other end of the box. Obviously, this will open the bellows M, which will withdraw the air from bulb C. Bulb C will then sink. This process repeats over and over to provide a perpetual motion machine.

While the patent was granted, something must have happened to deter production of the machine on a commercial scale. ▲▲



From the Patent Collection of Mike Revise

Arctic Operation

—Starts on page 32

design. There are no hardware stores or supply houses in the North Country, and even good sand and gravel often cannot be found near the construction site. There are no roads or railroads, and there are no major harbors equipped with heavy cargo handling machinery.

Furthermore, the majority of the Northern harbors are open only a few days a year. Therefore, when specifying machinery, equipment, or large structural members, the designer and consultant must be sure that they can be transported to the site and unloaded there. In several instances, loads consisting of large pieces of equipment and bulky structural members have been returned to the States because there was no way of unloading them. The consultant also must remember that all men, materials, and supplies (including all food, clothing, medicine, and comforts) must be transported from civilization to the job-site.

Airplanes may carry the men and many of the supplies to their destination, provided there is a suitable landing field. But planes are quite restricted in the weight and dimensions of their loads. All successful planning must consider these restrictions and arrange for large loads to arrive over the surface. The engineer and the Arctic transportation expert must work hand in hand with the purchasing agent throughout the planning.

It may well be that the bulk of the materials and equipment will require several means of transportation before they arrive at their final destination. In many instances, the first lap will be by ship or rail, followed by river boat, and finally sledges over ice roads. The Aluminum Company of Canada used such a combination when building two 250,000 kw power plants on the Peribonka in 1950-52. They shipped the heavy materials and the generators and turbines to the rail head in the late fall and early winter, and then carried them to the site on heavy tractor-drawn sledges traveling over the six-foot-thick ice of Lake St. John and the Peribonka River. In this way, they saved several million dollars which would otherwise have been required to build a road through the rough country.

Earlier, John Stadler used the same means for carrying all the steel and heavy machinery to the sites of the Mistassani Paper Company's mill at Dalbeau, Que., and to the powerhouse site farther up the river. ▲▲

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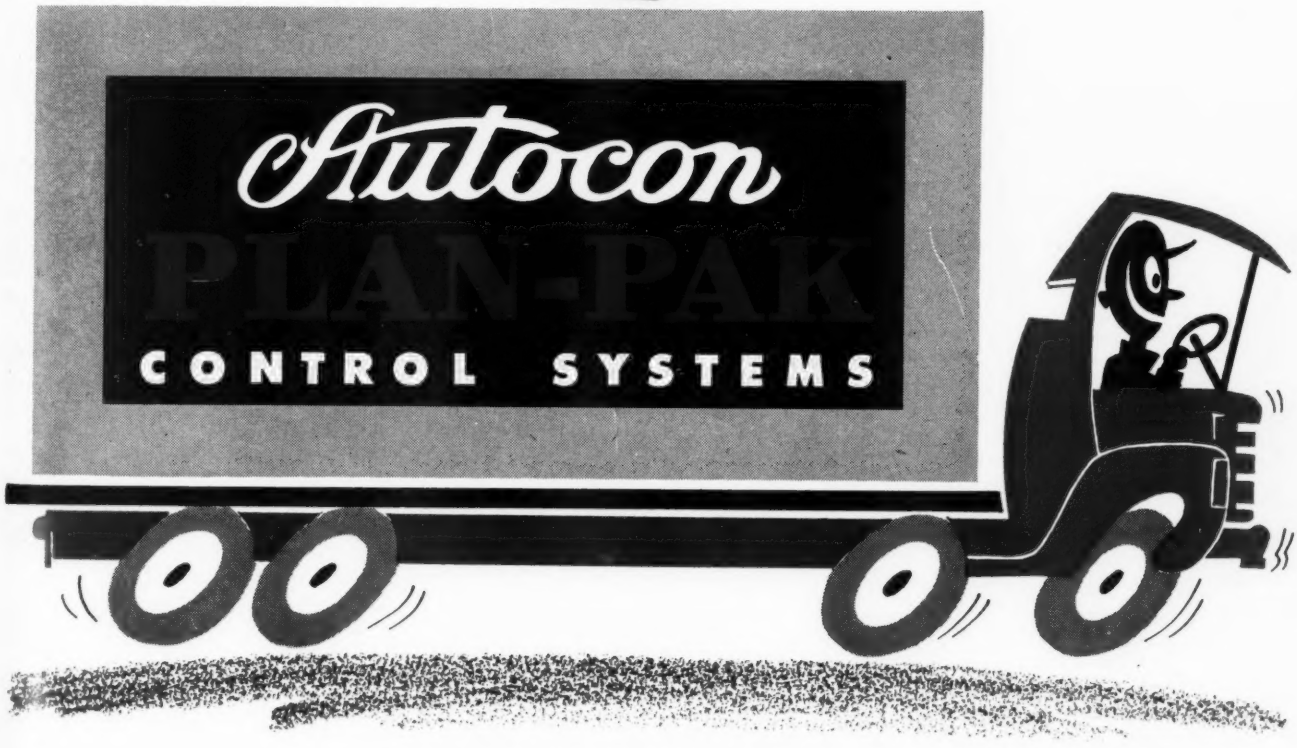

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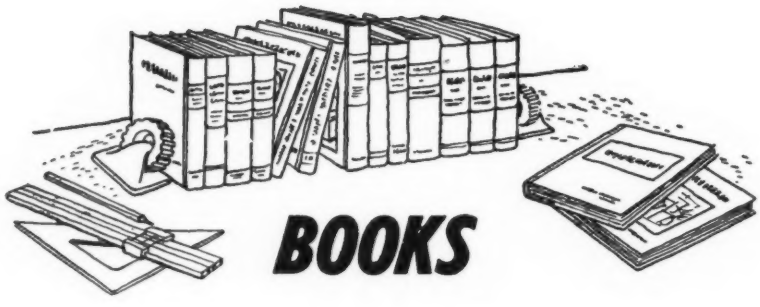

BOOKS

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DATA BOOK FOR CIVIL ENGINEERS, VOLUME III, FIELD PRACTICE, second edition; by Elwyn E. Seelye; John Wiley & Sons; Inc.; $7.50.

Reviewed by E. H. Hinkley
Assistant District Engineer
State Highway Commission of Wisconsin

This is a handy, pocket-size reference book for field use. It is written primarily for the inspector of civil engineering construction, but also should prove of value to those supervising such construction. Subjects covered include concrete construction, brick and stone masonry, timber structures, structural steel construction, grading for highways and airports, paving (concrete and bituminous), bridges, piling and foundation work, and sewer construction.

Each type of construction is covered in detail. A comprehensive listing of necessary inspecting equipment is given. The listing even includes such items as a plumb-bob, 6-foot rule, and special clothing and safety helmets. This is followed by a concise, but complete, listing of inspection procedures.

Sixty pages are devoted to soils and their behavior. Sampling and testing methods are detailed and a comparison is given between the Casagrande, PRA, and CAA system of soil classification. ASTM tests for liquid limit, plasticity index, maximum density, and optimum moisture are described. A field shear test is also included for field use. Included are numerous standard engineering tables, information on staking curves (including spirals), and instructions for adjusting instruments.

This statement on the book jacket appears to be justified: "Designed to provide the field engineer or inspector with sufficient data to enable him to carry out his job even when completely isolated."

TRANSISTORS, THEORY AND PRACTICE by Rufus P. Turner; Gernsback Publications, Inc.; 144 pages; $2.00.

Reviewed by Reinald S. Nielsen
Cook Research Laboratories

The purpose of Mr. Turner's book "is to provide an elementary explanation of transistor theory and operation for the thousands of practical electronic workers." In amplifying this statement, Turner seems to lump physicists and engineers in a group apart from "the practical man," though he realizes that even some engineers have been dismayed at the mathematical explanations of transistor operation currently available.

Ten chapters and an index comprise the volume. The first three chapters are devoted to semiconductor theory and the relation of the theory to the apparent transistor electrical characteristics. Chapters Four through Seven describe the operation of point contact, junction, and surface-barrier transistors as amplifiers, oscillators, and switches. A description of the duality concept relating these circuits to conventional vacuum tube circuits is included. Chapter Eight presents

many completely specified transistor circuits designed as amplifiers, oscillators, relays, and receivers. Chapter Nine presents fundamental circuits required in testing transistor characteristics, while Chapter Ten is a listing of currently available transistors and their published characteristics.

The theory covered is easily grasped. It necessarily simplifies many of the ideas presented, but Turner generally notes those situations in which his explanation is oversimplified. The chapters concerning practical circuits and transistor testing will give an individual the information necessary to intelligently experiment with applications of transistors.

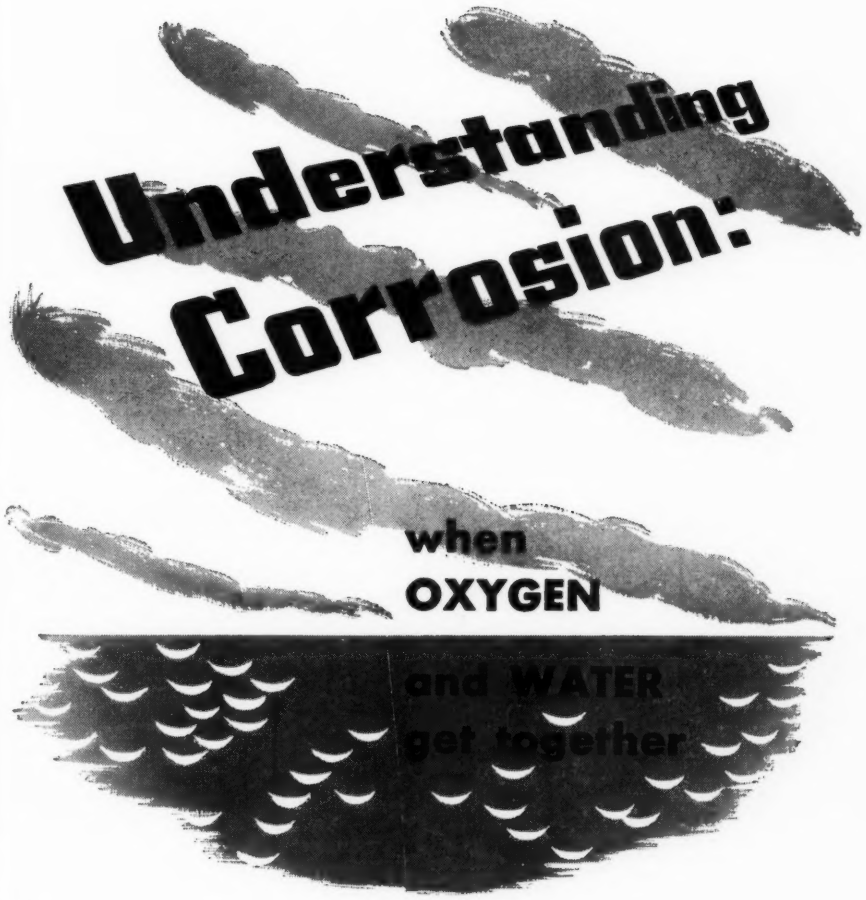
Mr. Turner serves his reader well by listing excellent bibliographies at the conclusion of each chapter. The references listed appear to have been well selected, and will gradually carry the reader into the deeper reaches of transistor and semiconductor knowledge.

While not as inclusive as its title, *Transistors, Theory and Practice* is a worthwhile introduction to transistors for the practical and nonpractical man alike.

TECHNIQUES THAT PRODUCE TEAMWORK by Warren H. Schmidt and Paul C. Buchanan; Arthur C. Croft Publications; $2.50.

An important study in group dynamics for administrators, this book was written by two men with years of successful experience in applying techniques that do produce teamwork. The authors point out clearly that if a staff is to accept more responsibility it must have goals that make sense to them. They show that responsibility and authority must operate within clear boundaries, that sharing responsibility differs from delegating responsibility, that sharing responsibility does not mean giving up responsibility, that sharing responsibility requires honesty and skills, that sharing is a two-way process which must be trusted by people.

The authors show how to build the kind of permissive climate that is all-important for creative staff action. Through example and explanation this book shows how to develop team spirit even in large groups, how to successfully apply the system of overlapping staff teams, how this system develops the skills of subordinates, and how it promotes loyalty among a firm's employees to the organization.



When free oxygen combines with atmospheric moisture or natural waters, the stage is well set for corrosive action. Controlling the degree and extent of that action are many related factors, variable in influence under differing circumstances.

The rate at which oxygen is transferred from atmosphere to a solution is, for example, directly proportional to the amount of exposed surface area of that solution, while the corrosion rate of immersed metal is, in turn, proportional to the oxygen concentration of the solution. Therefore, with all other factors stabilized, a reduction in exposed surface area will slow the oxygen-solution process, thereby greatly retarding corrosion.

How deeply metal is immersed, particularly in a quiet solution, is another determinant of corrosive action in which dissolved oxygen is the governing factor. Oxygen saturation, highest at and near the surface, diminishes with increasing depth as convection currents become less active. Corrosion at and immediately below the surface of a liquid is therefore far more severe than that encountered at greater depths.

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